CRANFIELD UNIVERSITY

Curie Park

Influencing factors for sustainable design implementation in the front-end of new product development process within the Fast-Moving-Consumer-Goods sector

School of Applied Science
Centre for Competitive Creative Design

PhD
Academic Year: 2011-2014

1st Supervisor: Dr. Fiona Charnley
2nd Supervisor: Dr. Phil Longhurst

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ABSTRACT

This study examines and verifies the influencing factors for sustainable design implementation in the front-end stages of New Product Development (NPD) process within the Fast-Moving-Consumer-Goods (FMCG) sector.

Despite many arguments that the early consideration of sustainable design is key to successful sustainable product development, there is a paucity of research that approaches sustainable design implementation from an NPD front-end perspective. Moreover, sustainable design research in the FMCG sector is rare in spite of the sector's substantial impact to the environment and society.

In order to gain holistic insights of the subject, this study explores different epistemic communities ranging from industrial sustainable design, engineering sustainable design, NPD front-end studies, to corporate social responsibility (CSR) studies. Subsequently, multiple FMCG case studies are conducted to confirm and elaborate the literature findings.

Among a total of 11 factors and 32 elements of case studies findings, nine factors and 19 elements confirm the previous findings, and two factors and 13 elements are newly identified. Six confirming factors including *senior management support, internal communication, cross-functional team,* and *supportive corporate culture* are common sustainable design and NPD front-end factors. Three other confirming factors including *sustainability tools*, and *sustainability champions* are distinct sustainable design factors, and two new factors including *balanced focus on growth* and *maturity of external contexts* and seven elements are specific to the FMCG context. Also a disparity between the perception and practice of the factors is highlighted. More positive, frequent evidence of the factors is observed in higher sustainability maturity level companies. A conceptual framework is suggested to explain the interrelationships of factors.

The research findings contribute to a holistic understanding of the nature of sustainable design implementation in the front-end of NPD for FMCG. The research is hoped to serve as guide for FMCG practitioners in diagnosing their sustainable design implementation within the NPD process, and developing more holistic sustainability strategy in a long-term view.

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Cycling home in the dead of night after a long day of writing, I could feel the super natural power oozing out of me. It was the answer to the never-ceasing question why on earth I am doing this often-painful challenge, a PhD. After all, doing a PhD is most rewarding; it made me hit the limit, push oneself harder, and eventually see more light. It also allowed me many grateful opportunities and friendships I would not have had otherwise.

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LIST OF ABBREVIATIONS

CSR	Corporate Social Responsibility
DfE	Design for the Environment
FMCG	Fast-Moving-Consumer-Goods
LCA	Life Cycle Analysis
MC	Mindful Consumption
N/A	Not Available (or Not Applicable / No Answer)
NPD	New Product Development
SD	Sustainable Design
SME	Small and Medium-sized Enterprise
SML	Sustainability Maturity Level
TBL	Triple Bottom Line

1. Introduction

This chapter sets out the background of the research, how this research is motivated, and why it is relevant to the real world. It is followed by addressing the gaps that exist in academia and industry practice. The chapter also states the aim, objectives, and context of the research. The overall outline of the thesis structure is introduced in a graphical format.

1.1 Background of the research: Design, Consumer and Sustainability

Since the late 1980s, design has been highlighted as one of the critical areas for successful business (Cooper and Kleinschmidt, 1987, Lawrence and McAllister, 2005; Verganti, 2006; Esslinger, 2011; Micheli *et al.*, 2012). Design can help increase market share, consumer awareness, competitive advantage and financial performance of products/services (Goffin and Micheli, 2010).

1.1.1 Design and sustainability

On the other hand, a worrying discourse over design's harmful impact on the environment and society is available within the design community. As early as the 1890s, William Morris and John Ruskin's Arts and Crafts movement protested against the effects of industrialisation and wasteful consumerism. During the 1970s, Buckminster Fuller and Victor Papanek strongly criticised the many environmental harms that design practices were causing. In line with the early design critics, the

renowned design author Margolin (1998) criticized that designers were taking the role of blindly encouraging consumerism:

> *"… Most product designers have remained locked into the aims and arguments of their business clients… designers have never come strongly against the expansion model of economic growth."* (p.86)

He asks designers to disengage from consumer culture and to rethink their role in the world. He argues that designers should reinvent design culture and engage with local and global problems. Ironically, all the arguments betray the fact that design does have the potentiality to contribute in creating a more sustainable world, as well as make business more successful.

As he also points out, Agenda 21 from Rio Earth Summit 1992 clearly defines the challenges that humankind is facing into six themes, and thus should also be addressed by designers and the design discipline:

a) Quality of life,

b) Efficient use of natural resources,

c) Protecting the global commons,

d) Managing human settlements,

e) The use of chemicals and the management of human and industrial waste,

f) Fostering sustainable economic growth on a global scale.

To further discuss sustainable design in Margolin's viewpoint, a distinction between industrial design and engineering design should be made. Although both design fields make efforts to embrace sustainability to a certain degree, engineering design has deeper roots in sustainability due to its innate dependency to industrial systems. Engineering designers concern more with technology and technical solutions within manufacturing environments whilst industrial designers have more to do with consumer culture (Sparke, 2004). With this distinction taken into account, this research examines sustainable design theories and practices from both engineering and industrial design perspectives to understand the complexity of sustainable design, industry, and consumers.

1.1.2 Sustainable design at the front end in the consumer goods sector

In this light, this research ultimately seeks how to deviate design from blindly catering to consumerism, and to lead consumers towards a more sustainable direction at a large scale. Hence the current research focuses on the fast-moving-consumer-goods (FMCG) sector. FMCG is a fast-growing industry with the world's top 250 players' aggregated sales reaching as high as $2.82 trillion (Deloitte, 2012). The environmental impact of this sector is substantial. For example, approximately 80% of products go to the landfill after a single use, and over 90% of them are within six months (Hawken, *et al.*, 2013). Also the green house gas emission of top 10 FMCG brands is higher than the total emission of all the Nordic countries (Oxfam, 2014).

It is well known among sustainable design research that the front-end of new product development (NPD) process is where the most effective sustainable design implementation can take place. Therefore, attempts at enhancing the sustainability performance of the FMCG sector should focus on the early stages of NPD, but any examples of such initiatives or research are surprisingly rare. The paucity of knowledge of the dynamics in implementing sustainable practices to this part of the sector poses a serious deficiency in addressing the issue of sustainable design as a whole and thus warrants further research.

1.2 Research gap: academia and industry

Research gaps in knowledge and practice were identified, which are collated into three groups that this research intends to address (Figure 1.1).

1.2.1 Gap I: Sustainable design theory and a lack of industrial practice

Firstly**,** over the last couple of decades, there is no shortage of discourses on the importance of sustainability across academia, industry and politics; mounting research

about sustainability consideration of environmental, economic and social factors can be found (IUCN, 1980; Ehrenfeld, 1997; Elkington, 1998).

Figure 1.1 Research gaps

Despite the wealth of research, when it comes to successful sustainable design in industry practice, the reality appears to be otherwise; an apparent disparity exists between the academic treatment of sustainable design, and the provision of its substantial evidence (Boks, 2006). Most of the success cases are merely satisfying at a niche market or prototype level (Baumann *et al*., 2002). Although several examples of green products are shown, the same examples tend to repeat themselves over time, and do not lead to an increase in numbers. Ehrenfeld (2005) argues that many companies publish shiny 'sustainability reports' along with the annual reports, but none of them creating true sustainability. He believes it can be as bad as merely serving as 'feel-good' marketing, which fails to deliver meaningful satisfaction to the customers and environment.

Hence, the first gap offers an opportunity for investigating the reality of sustainable design practice in industry.

1.2.2 Gap II: Lack of sustainable design in NPD front-end research

Secondly, the emphasis on 'end-of-pipe' type environmental solutions in the late 1980s has now moved towards the preventive approach (van Weenen, 1995; Roy, 2000; Johasson, 2002; Kurk and Eagan, 2008). It encourages active involvement from the

beginning of the problem than reducing the amount of harmful emissions and substances at a later stage, i.e. manufacturing process (Sherwin, 2000). This transition of the focus from the rear-end to the front-end of new product development (NPD) process allows chances for a more fundamental application of sustainable design from the beginning (Sherwin, 2000; Goffin, 2012). Accordingly, a substantial number of studies emphasize the importance of considering sustainability issues in the early stages (Argument *et al*., 1998; Sherwin, 2000; Johansson, 2002; Bhamra, 2004, McLellan and Corder, 2013). However, little research is done about implementation or operationalization of sustainable measures within the front-end stages of NPD process. In short, this gap brings another research opportunity to diagnose how the introduction of sustainable design at the front-end of NPD works and what factors have an impact. Particularly, much of the research centers around the Stage-Gate® model which is the predominant process in NPD research, but somehow does not incorporate the sustainable design research field (Boks, 2006; Deutz *et al*., 2013). The background of this gap is further elaborated in section 2.3.1.

1.2.3 Gap III: Lack of sustainable design study in the FMCG sector

Lastly**,** unlike high-value sectors such as electronics, automobiles or architecture, little sustainability-related research is available in the FMCG sector. Arguably, implementation of sustainable design in FMCG can help make a substantial positive change due to its fundamental economical position and considerable size. Nonetheless, the FMCG sector is surprisingly less studied within sustainability research, and few industrial practices offer empirical evidence at a major scale. The importance and need of expanding the research focus towards the FMCG sector cannot be overemphasized. A research opportunity is highlighted in this gap to obtain a deeper understanding of FMCG from the sustainability perspective, which can help manage its anthropogenic impact to the world. The detailed view on FMCG and sustainable design is discussed in section 2.4.

To conclude, the rarity of studies that address the above gaps is in stark contrast to the repeated emphasis found in previous works, and this very fact may act as a hindrance to the industry for thoroughly adopting sustainable design. This research addresses the above three gaps by specifically investigating the influencing factors for implementation of *sustainable design* into the *front-end of NPD* process within the *FMCG* context.

1.3 Research aim and objectives

The purpose of the thesis is to address the aforementioned research gaps in knowledge (see Section 1.2), and to provide practitioners with guidance to diagnose and enhance their sustainable design implementation within the Fast-Moving-Consumer-Goods (FMCG) industry sector: a less researched industry area, yet with substantial environmental / social impact. The aim of this PhD research, therefore, is:

> To increase understanding of the influencing factors for sustainable design implementation within the FMCG sector, with a focus on the front-end of new product development (NPD) process: the most effective stage to incorporate sustainability considerations.

In order to achieve this aim, three research objectives are formulated as follows:

a) To explore existing research and gather insights into the success factors and barriers across sustainable design and NPD front-end research.

b) To empirically identify sustainable design implementation factors at the NPD front-end within the FMCG context, building on previous findings.

c) To investigate the actual roles and relative importance of the identified factors at companies of differing sustainability maturity levels.

For the fulfilment of Objective A, a systematic cross-disciplinary literature review was undertaken. Details of the literature review strategy are discussed in Chapter 2.

For the fulfilment of Objective B, five comparative case studies at five FMCG companies were conducted. The analysed results of the case study were compared to previous findings. The methodology is discussed further in Chapter 3.

For the fulfilment of Objective C, case study data were synthesised using multiple triangulations. The outcomes and the conceptual framework are presented in Chapter 6.

1.4 Research questions

This section sets out the research questions formulated to fulfil the research objectives. The questions, formulated through the exploratory literature review and field studies during the Stage 1, are as follows:

> RQ 1. What are the influencing factors[1] for the front-end of NPD process identified in previous research and how do they apply to the FMCG sector?
>
> RQ 2. What are the influencing factors for sustainable design implementation identified in previous research and how do they apply to the FMCG sector?
>
> RQ 3. What are the distinctive factors[2] for sustainable design implementation within the FMCG sector?
>
> RQ 4. How are the factors applied in practice across companies of differing sustainability maturity levels?

The answers for Research Question 1 and 2 are partially sought through the literature review and completed by qualitative data and analysis. Research Question 3 is answered primarily by qualitative data, which is supported by quantitative evidence. Research Question 4 is answered through the synthesis of quantitative data analysis.

[1] Factors that affect the success or failure of the process
[2] Factors that affect the success or failure of the process, specifically to the FMCG context

1.5 Thesis structure

This thesis is comprised of seven chapters. A summary of the forthcoming chapters is elaborated below. Figure 1.2 illustrates the structure and chapter dynamics.

Chapter 1: Introduction provides an overview of the thesis, from the research background, research gaps, research aim and objectives, research questions, to research context. It also includes a summary of the research design.

Chapter 2: Literature review reviews the literature to position this study across a number of research fields. It also lays the theoretical grounds for the research aim (see Chapter 1), and research questions (see Chapter 1). Various insights were gathered encompassing different epistemic communities.

Chapter 3: Methodology sets out the research methodology that this study deployed in a sequential format. Also, the rationale for the research methodology selection is provided. The ethical considerations and the limitation of the chosen methodology are stated.

Chapter 4: Findings 1 analyses and presents the detail of two in-depth case studies. Factors, identified from existing research, and their application within the two FMCG industry cases are introduced. Discussion is made on the implication for further verification.

Chapter 5: Findings 2 presents the data analysis of three verification case studies. The factors and elements from Chapter 4 are confirmed and elaborated.

Chapter 6: Discussion synthesises the key findings from Chapter 4 and 5, and answers research questions. Also, a conceptual framework that explains the relationship of factors is suggested.

Chapter 7: Conclusion offers the contributions to knowledge, which address the research gaps. The implication for practitioners, designers and researchers are suggested, and the strength and limitation of research follow. A reflection on further research opportunities, and the final reflection concludes the thesis.

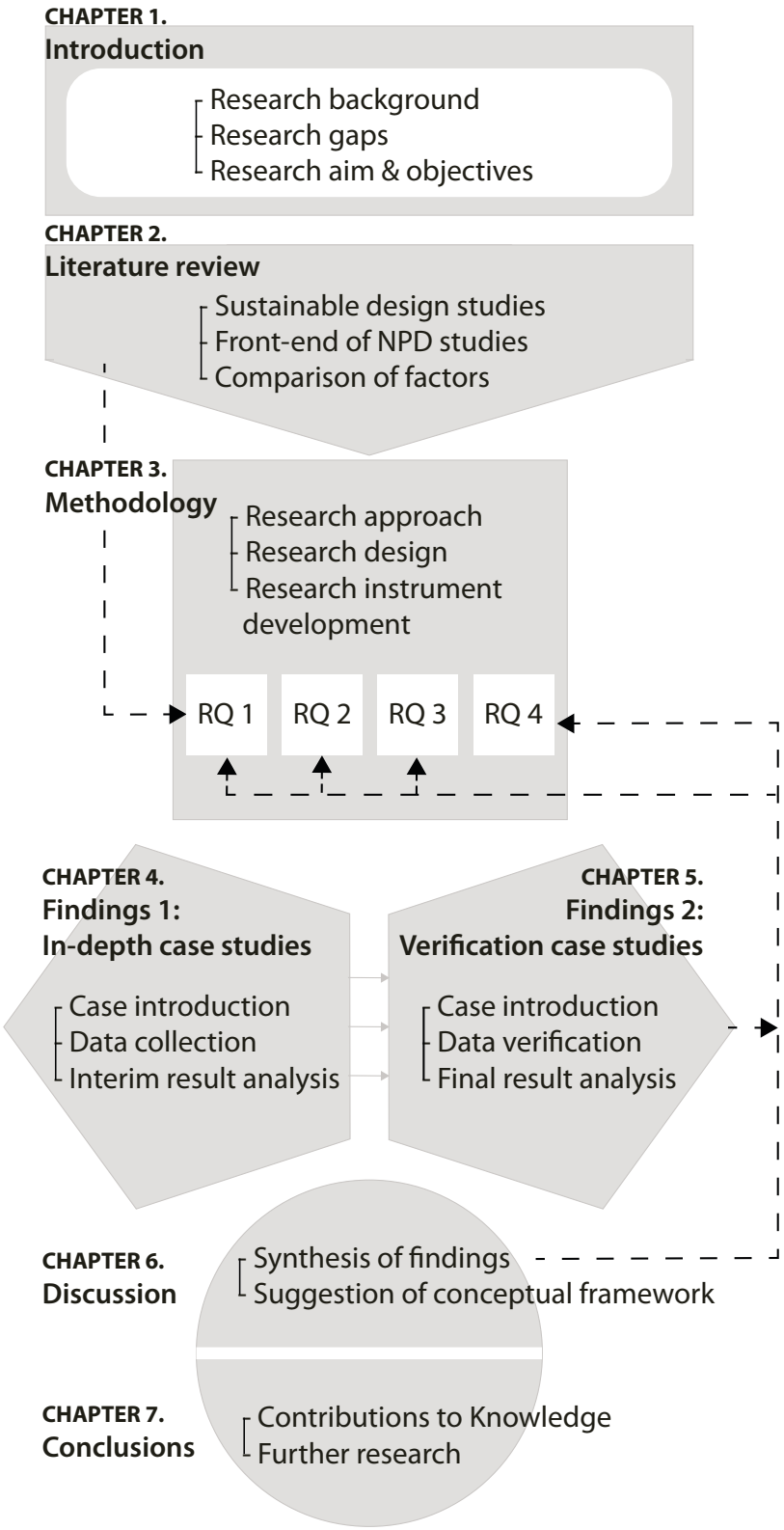


Figure 1.2 Thesis structure

2. Literature Review

This chapter explores existing literature on success factors and barriers for sustainable design implementation, along with the factors that influence the front-end stages of the NPD process. Due to the interdisciplinary nature of sustainable design, this study penetrates various related disciplines: industrial sustainable design, engineering sustainable design, new product development (NPD) front-end management, and corporate social responsibility (CSR) studies.

2.1 Literature review methodology

This section gives an account of the methods used in the literature review for this study.

The relevant literature on sustainable design and NPD front-end was reviewed using a combination of several strategies at five phases. First, exploratory selection of the key relevant journals was made using the ABS Academic Journal Quality Guide (2010) and Cranfield University Journal Guide (2011). Although the journal ranking guides are not an absolute measure of the quality of journals, they can provide a reliable platform to start identifying journals with general recognition. A total of 15 3-4 star peer-reviewed journals were initially selected as relevant and influential. Table 2.1 shows the list of the journal selection and ranking. This phase was exploratory and covers wide range research areas from design, environmental engineering, innovation, and management. Second, each volume of the selected journals was scanned in chronological order from 1999 to 2011. This scanning allowed shortlisting 360 articles as broadly relevant, and enabled an overall understanding of the fields and approaches to the subject. The first two phases of review activities allowed narrowing down the research topic of

sustainable design and front-end factors. Third, 58 key articles in front-end, and NPD studies were highlighted by a colleague who is an NPD research expert, resulting five relevant ones and a number of key authors in this field such as Cooper, Kleinschmidt and Rosenthal.

Table 2.1 Initial categorisation of high ranking/ relevant journals

Categories	Journal titles	Rankings
Design	Design Issues	
	Design Studies	IF 1.354
Environmental engineering	Journal of Cleaner Production	IF 2.425
Innovation	Journal of Product Innovation Management	★★★★ (ABS)
Strategic Management	Strategic Management Journal	★★★★ (ABS)
	Journal of Economics and Management Strategy	
	Long Range Planning	★★★
Management	Academy of Management Review	★★★★ (ABS)
	Academy of Management Journal	
	Journal of Management	
	Journal of Management Studies	
	Harvard Business Review	
	British Journal of Management	
	California Management Review	★★★ (ABS
	MIT Sloan Management Review	

Fourth, electronic databases such as Science Direct, EBSCOhost (Business Source complete), and Web of Knowledge were used to search for the keywords “green design”, “eco design”, “sustainable design”, “design for environment”, “front-end”, and “success factor” in the title, abstract, keywords of an article. Search options that were used for each database are given in Table 2.2.

Table 2.2 Database search options for review

Electronic database	Search options	Publication
Science Direct (Elsevier Science Journals)	Green or eco or sustainab, design, environment, process, NPD In Title, abstract, keywords	Academic journals Conference papers
EBSCOhost (Business Source complete)	Green or eco or sustainab, design, environment, process, NPD, front-end In Title, abstract, keywords	Academic journals Conference papers
Web of Science	Impact factors	Journals

Next, by cross-referencing between these articles the scope of the literature review was further widened to include additional material from other relevant journals. Consequently, 22 papers are identified as key papers with high relevant to present research. Table 2.3 sets out the papers and their main findings under five research area categories.

Table 2.3 Analysis of key papers

MAIN FOCUS	AUTHOR	YEAR	TITLE	METHOD & SAMPLES	MAIN FINDINGS
SUSTAINABLE DESIGN	Dewberry, E. and Goggin, P.	1996	Spaceship ecodesign	Theory	Eco design terminologies
	Madge, P.	1997	Ecological Design: A New Critique	Theory	Early eco design research critic
	Fletcher, K.T. and Goggin, P. A.	2001	The dominant stances on ecodesign: A critique	Theory	Eco design terminologies
	Baumann, H., Boons, F. and Bragd, A.	2002	Mapping the green product development field: engineering, policy and business perspectives	Cross-disciplinary review of 650 articles	Defines severe lack of systemic perspective
	Bhamra, T.	2004	Ecodesign: the research for new strategies in product development	Theory	Exemplary definition of sustainable design
	Karlsson, R. and Luttrop, C.	2006	EcoDesign: what's happening? An overview of the subject area of EcoDesign and of the papers in this special issue	Overview of eco design scene	Specification and goal setting in early product development phase is more important than eco design tools
	Bovea, M.D. and Perez-Belis, V.	2012	A Taxonomy of Ecodesign Tools for Integrating Environmental Requirements into the Product Design Process	Review	Thorough review and 6 classification of eco design tools

	Short, T., Lee-Mortimer, A., Luttropp, C. and Johansson, G.	2012	Manufacturing, Sustainability, Ecodesign and Risk: Lessons Learned from a Study of Swedish and English Companies	Survey with 126 UK and Swedish manufacturing firms (Large and SMEs)	Clear-cut comparison/ assessment of eco design practices in two countries
SUSTAINABLE DESIGN FACTORS	Lenox. M. and Ehrenfeld, J.	1997	Organizing for effective environmental design	In-depth case studies of 4 electronic firms	
	Johansson, G.	2002	Success factors for integration of ecodesign in product development	Sythesising 28 literature on success factors	Thorough review of papers covering different fields
	van Hemel, C. and Cramer, J.	2002	Barriers and stimuli for ecodesign in SMEs	77 Dutch SMEs' ecodesign behaviour in 1997	
	Boks, C.	2006	The soft side of ecodesign	Semi-structured nterviews with 4 electronics firms in Japan & Korea in 2003	Socio-psychological factors
	Verhulst, E.	2012	The Human Side of Sustainable Design Implementation from the Perspective of Change Management	Qualitative: semi-structured interviews in 8 firms	Four clusters of human factors
	De Medeiros, J.F., Ribeiro, J.L.D., and Cortimiglia, M.N.	2014	Success Factors for Environmentally Sustainable Product Innovation: a Systematic Literature Review	Review	Thorough / latest review of sustainable product innovation papers (Four major factors)
SUSTAINABILITY MANAGEMENT	Ehrenfeld, J. R.	2005	The roots of sustainability	Theory	Ground for sustainability and management
	Grayson, D. and Exeter, N. (Ed).	2012	Cranfield on corporate sustainability	Theories and Case studies	Compilation of 12 articles of management academics in Cranfield
	Felekoglu, B., and Moultrie, J. (2014	2014	Top Management Involvement in New Product Development: A Review and Synthesis	Review	Extensive literature review of top management support studies
FRONT-END	Khurana, A. and Rosenthal, S.R.	1998	Towards holistic "front-ends" in new product development	Theory	The key roles, a few more components to front-end activities
	Kim, J. and Wilemon, D.	2002	Focusing the fuzzy front-end in new product development	Theory	Define Fuzzy front-end Success strategy, failure and objectives of FFE
NPD AND STAGE- GATE	Cooper, R. G.	1990	Stage-Gate systems: a new tool for managing new products	Empirical study of 252 new product history of 123 companies	Developed Stage-Gate approach
	Cooper, R. G. and Kleinschmidt, E.J.	1991	New product processes at leading industrial firms	Empirical studies of 500 Canadian companies	Summery of the fundamental success factors to new product development
	Cooper, R. G.	2008	Perspective: the Stage-Gate idea-to-launch process-update, what's new, and NexGen systems	Theory	Characteristics of stage and gates, new revision

The main findings on the far right columns are the reasons for being the key papers for this research that either form the ground of the research topics and questions or provide the structure for the argument. Each paper is reviewed in the following sections in details.

2.2 Potential benefits of sustainable design

Sustainable design is defined as 'design that addresses all environmental, economic, and social impacts throughout the product's life cycle without compromising other criteria such as function, quality, cost, and appearance' (ECO2-IRN, 1995; Bhamra and Lofthouse, 2007). Over the past couple of decades, it has become a thriving research area as well as an emerging business imperative. Sustainable design is widely regarded as an effective medium, or a conceptual framework, to address complex sustainability issues. Three primary aspects of sustainable design are as follows:

a) Environmental responsibility: material usage, manufacturing methods, transportation capacity, distribution channels, energy consumption, longevity, and waste,
b) Social benefits: product users, and stakeholders (e.g. employees in manufacturing, supply chain, sales, etc.),
c) Economic viability: profit making for the company.

The potential benefits of sustainable design are twofold: first, it can be an important source of attaining competitive advantage. It helps differentiate products, increase revenues, strengthen reputations, improve company images, satisfy customer demands, and abide by with regulations (Lenox and Ehrenfeld, 1997; Nidumolu, *et al*., 2009; Goffin, 2012). Second, it enables companies to convert challenges into opportunities. It promotes product innovation, product quality improvement, manufacturing cost reduction, risk minimization, and development of new markets (Pigosso *et al.*, 2013). Santolaria *et al.* (2011) attempt to illustrate the link between

eco-design practices and innovation performance within the Spanish industrial context. Although this study could have been a worthwhile empirical study to cover the less explored area for sustainability studies: Spain and its uncertainty issues, this study needs to be interpreted with caution. Their presentation of the research result can be misleading due to the jump in the logic. No clear relevance can be found to back up their argument that sustainability is a cardinal driver for innovation. Moreover they present as if the sample size is as large as 10,000 professionals when the actual response rate is 8.44%: total 846 completed surveys.

At the product and industry level, several business management studies provide considerable examples of success cases of sustainable products and services in the industry (Roberts and Gehke, 1997; Lippmann, 1999; Tierney, 2002). Plouffe *et al*.'s (2012) recent study provides empirical evidence of economic benefits of ecodeisgn products. 80% of total industrial cases (24 out of 30) in France and Quebec experienced positive economical impact. 10 companies experienced higher margin and increased revenues, 13 companies noted equal margin and increased revenues, and one company had higher margin and stable revenues. Even though most of the sample companies cannot always have a precise quantification of the revenues or varied costs, the result determines the profitability of products in most of them. Percy (2000) even argues that companies that fail to deliver any of the three imperatives of sustainable development (i.e. economy, environment and society) will lead to a reduced competitive advantage in the long term. More recently, asserting sustainability as an emerging business megatrend, Lubin and Esty (2010) go far as to assert *"managers can no longer afford to ignore sustainability as a central factor in their companies' long-term competitiveness."* They believe the sustainability strategy imperative will be integrated into the daily practices of every company of all types and sizes.

2.3 Sustainable design and the Front-end

2.3.1 Early adoption of sustainable design

A recurring argument among sustainable design research is a constant emphasis on the early adoption of sustainability consideration in the NPD process. Numerous academics claim that the earlier sustainable design is considered, the more impactful it can be (Argument *et al*., 1998; Sherwin, 2000; Johansson, 2002; Bhamra, 2004, McLellan and Corder, 2013).

The early implementation of sustainable design is critical to the success or failure of the product development. The most critical decisions are made at the early stage of NPD process concerning cost, appearance, material selection, process, energy source, performance, environmental impact, longevity, durability, and repairability (Simon *et al*., 1998; Lofthouse, 2004; Jeswiet and Hauschild, 2005; Karlsson and Luttropp, 2006; Kurk and Eagan, 2008). It is these decisions that dominate how to handle the sustainability issues and usages of tools in the following stages (Poole and Simon, 1997; Frei, 1998; Sandstrom and Tingstrom, 2008). From the management perspective, this means that introducing sustainable design at the front-end stages of the NPD process allows more chances to consider different aspects of sustainable design into products and thus lead to more holistic results of the whole NPD process (van Weenen, 1995; Roy, 2000; MacMillan *et al*., 2001; Esslinger, 2011; Goffin, 2012). Karlsson and Luttropp (2006) make clear that specification and goal setting in early product development phase is even more important than using eco design tools. Esslinger (2011) says *"Designers... have a strategic opportunity to affect the early stage of the product life cycle management system."* He argues that environmental considerations should become 'inherent' in the design process.

Meanwhile, Sherwin and Evans (2000) conducted empirical research to question whether indeed the early stage was always the best place to maximize the impact. They conclude that the best place to integrate the environmental consideration may

vary to the slightly later design stages of NPD according to the type of project. O'Hare (2009) gives a little more specified view in his doctoral thesis that recommended eco-innovation should be organised and sit ahead of a conventional NPD process.

Despite abundant supporting arguments as shown above, there still remains a tendency in industrial practice not to include sustainability considerations at early stages. A lack of integration is recognized between eco design and the broad context of product development, management and corporate strategy by numerous researchers (Baumann *et al*., 2002; Luttrop and Lagerstedt, 2006; Pigosso *et al*., 2013). Deutz *et al*., (2013) argue that this represents a fundamental flaw since the opportunities for environmental improvement are missed. Moreover, there is a significant lack of academic research addressing the front-end stage of NPD in the sustainable design research area. There has been *"too many normative suggestions with little practical relevance or testing"* (Boks, 2006). Instead, the majority of the sustainable design research has focused on the rear end of the NPD stages, e.g. development, measurement and simulation.

The recent and relevant research focusing on sustainable design implementation at the front-end of NPD was from Petala *et al.*, (2010), Deutz *et al.* (2013), and Bocken *et al.*, (2014). Petala *et al.* explored companies that are proactive in responding towards sustainable development, which are characterised as companies that integrate sustainability into the early stage of the NPD process. However, in their study, the front-end is only considered as a partial backdrop for a more general inquiry on sustainable design without any particular analyses devoted to the stage. Deutz *et al.* analysed 93 survey data from UK manufacturing companies, and found that the chances for environmental improvement are often missed because companies tend to exclude environment at the conceptual stage, i.e. front-end. Instead, companies consider ecodesign as one of design criteria than a functional requirement, letting environmental considerations clash with other design criteria e.g. cost. More recently Bocken *et al*. (2014) conducted an empirical study of the front-end of eco-Innovation for 42 small and medium enterprises (SMEs) in the Netherlands. Although the topic of eco-innovation concerns a somewhat different subject area, eco design has been

acknowledged as a form of eco-innovation, making it a rare example of relevant work to subject. Their research shares the consensus about the lack of understanding of eco-innovation mechanism at the front-end of NPD, and contributes the following characteristics of front-end eco-innovation:

a) Satisfying (green) consumers and generating revenue are the main drivers,
b) Systematic but informal manner,
c) Multi-disciplinary, creativity skills and environmental knowledge are essential,
d) Engages with external stakeholders, e.g. customers, suppliers to generate novel ideas,
e) SMEs front-end-eco-innovation is similar to larger companies.

Especially E) demonstrates the applicability of SME attributes to larger company contexts, providing a valuable insight for future research in the reverse context.

Arguably, the rarity of the follow-up study may act as a hindrance for the industry to thoroughly adopt sustainability. The lack of research in front-end activities of sustainable design can be attributed to certain characteristics of the front-end innovation, as given below:

a) The front-end is intrinsically non-routine, dynamic, uncertain and unstructured,
b) The front-end is difficult to generalize,
c) The level of formalization is low.

(Murphy and Kumar, 1997; Khurana and Rosenthal, 1998; Kim and Wilemon, 2002; Sandstrom and Tingstrom, 2008).

Nevertheless, rather than developing a new tool which just adds to the abundance of rear-end research, there is a pressing need of diagnosing how the front-end of the stages works best and what factors impact successful sustainability implementation.

2.3.2 Front-end factors

This section examines the scope of NPD, the Stage-Gate Model®, and the front-end of the NPD process.

NPD process is where the success or failure of the business sustainability initiatives is determined, and the Stage-Gate Model® by Cooper (1990) is by far the most common NPD process to manage each stage and function related to NPD (Figure 2.1). Stage-Gate® designates the responsibilities of respective functional areas at each 'stage' of the process and defines the goals to achieve at each 'gate' before making decisions to move onto the next stage. The characteristics of the Stage-Gate model® are as follows:

a) Breaks the innovation process into three to seven stages,
b) A multifunctional team with a team captain or project leader,
c) Cross-functional: involving R&D, manufacturing, marketing, quality control, Designed for speed and quality of execution: parallel processing of activities (concurrent within the stages),
d) Effective, timely gate decision keeps the project moving along,
e) Designed to gather information to reduce uncertainty and risks,
f) Each stage costs more than the preceding one,
g) Each gate makes a go/no go decisions as quality-control check points,
h) Needs an agreement to move to the next stage,
i) Separates the stages, providing review of inputs and deliverables.

(Cooper and Kleinschmidt, 1991; Cooper, 2008)

Most companies use a type of Stage-Gate® process within their NPD process for benefits such as:

a) Helps make the best decisions for the overall project by providing a set of objectives at each gate,
b) Prevent oversights by guiding project leaders to define project at each stage,
c) Save time by elapsing each time period,
d) Provide an overview and better control of the entire NPD process for senior managers.

(Cooper and Kleinschmidt, 1991; Cooper, 2008)

As argued previously (Section 2.3.1), although it is claimed that if a company wants to be successful in sustainability sustainable design has to be embraced at every stage, especially in the beginning, adding sustainability consideration to the NPD process heightens the complexity of an already complicated process. Thus Goffin (2012) argues that building sustainability perspective on established technique is most effective.

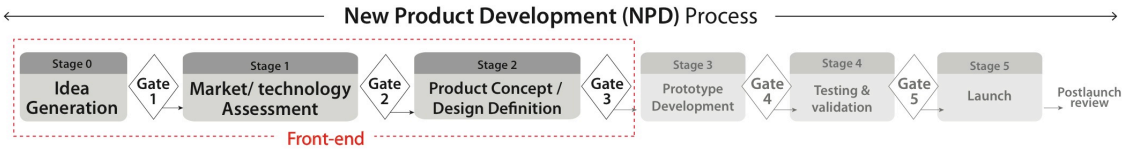


Figure 2.1 Front-end of NPD based on Cooper (1990)'s Stage-Gate Model®

Goffin (2012) calls for attention to stage 0, 1, and 2 of Stage-Gate (Figure 2.1). The discovery / idea generation stage (Stage 0) is where a vision for a sustainable product is developed. Unless done by the sustainability expert at these early stages, the reverse implementation by other team members at a later stage would be difficult, and is unlikely to take place. In other words, those initial stages are called the 'front-end' i.e. the activities that come before the formal and well-structured NPD or Stage-Gate process (Koen *et al.*, 2001). It is also considered as 'the period between when an opportunity is first considered and when an idea is judged ready for development' (Kim and Wilemon, 2002). The 'front-end', also called predevelopment activities, is collectively recognized as a difficult part to manage. However, well-managed front-end activities are much more influential than the improvement of the actual development

stages (Khurana and Rosenthal, 1998). The major objectives of the front-end activities are as follows:

a) Selection of the right opportunity,

b) Rapid, efficient selection process.

(Kim and Wilemon, 2002)

And the benefits of systemic approach to the front-end are:

a) Appropriate screening of new products for development and market potential,

b) Creating a clearly defined product prior to development.

(Murphy and Kumar, 1997)

The front-end activities are so crucial that the success or failure of product is determined even before the NPD project takes place (Cooper and Kleinschmidt, 1986; Link, 1987; Souder, 1987; Cooper, 1988; Dwyer and Mellor, 1991; Moenaert *et al*., 1995; Murphy and Kumar, 1996; Brown and Eisenhardt, 2004; Langerak *et al*., 2004).

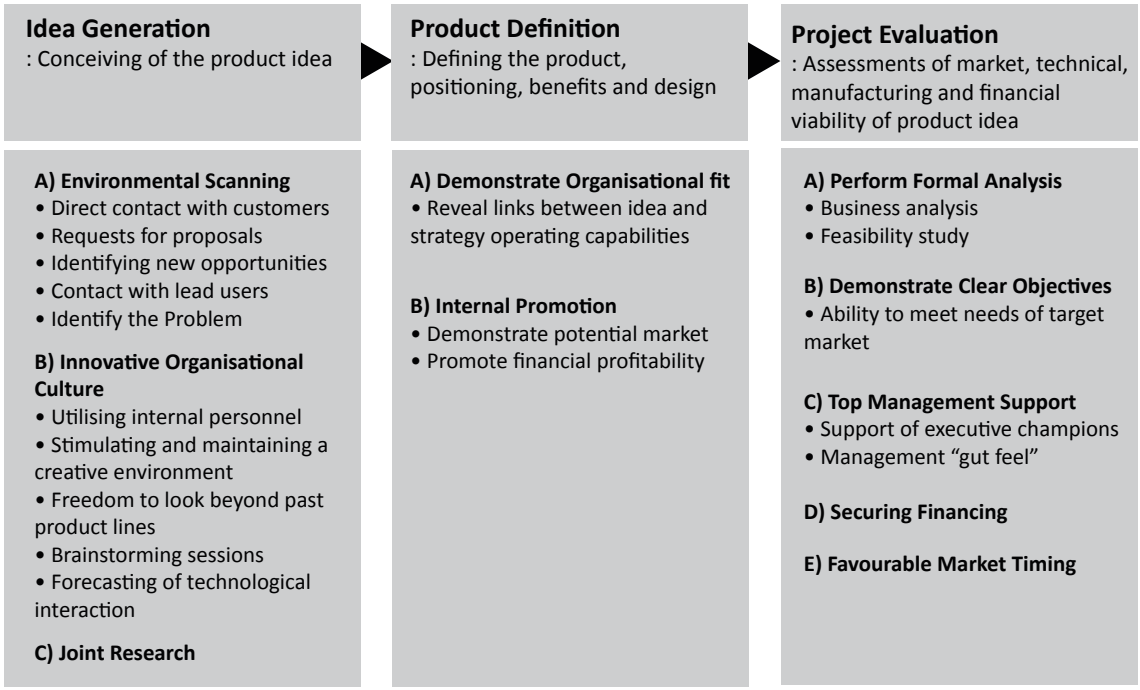


Figure 2.2 A model of predevelopment activities (Murphy and Kumar, 1997)

Based on Cooper's original articulation of predevelopment's three stages in 1988, Murphy and Kumar (1997) elaborate each stage through a survey research of 15 high tech firms in Canada (Figure 2.2).

This Model serves as a checklist for key activities and factors in three stages of front-end. Also, it is generally applicable to sustainable product development.

Building upon the above result, Khurana and Rosenthal (1998) conducted in-depth case studies of 18 business units from 12 American and Japanese firms from various industry sectors. They suggest a fresh view to the success factors of front-end activities such as a holistic approach to effectively link business strategy, product strategy, and product-specific decisions. Four years later, Kim and Wilemon (2002) consolidated success factors of front-end activities as follows:

a) Cross-functional team responsible for the key activities,

b) Project champion as a facilitator, communicator and motivator,

c) Executive review committee to provide checkpoints throughout NPD,

d) Senior management to provide guidance of product strategy and plans,

e) Alignment of new product plans, R&D, process, and marketing,

f) Communication among R&D, engineering, and marketing functions,

g) Holistic consideration of complete product development portfolio while making decisions,

h) Process owner helping drive the front-end, and give it breath and scope,

i) Collaborative culture not to ignore the key development requirements,

j) Explicitly defining to clarify concept, and secure early agreement,

k) Adapting front-end process to product, market or organizational context,

l) Building an information system,

m) Formalization and creation a holistic fuzzy front-end process,

n) Emphasis on customer involvement,

o) Attainment of internal cooperation and support,

p) Cooperation with suppliers and intermediaries,

q) Seeking of horizontal cooperation.

2.4 Sustainable Design and FMCG

This section defines the context of this research: the Fast-Moving-Consumer-Goods (FMCG) sector. The description of FMCG and its relevance of sustainable design are described.

The FMCG sector is comprised of manufacturers of non-durable retail products (e.g. toiletries, soft drinks, and groceries). FMCG products are the everyday commodities that are generally replaced or fully used up over a short period of time: days, weeks or months. The below characteristics of the FMCG industry entitle its significance in sustainability research. From the consumer's perspective, FMCG products are of

a) Frequent purchase,

b) Low involvement,

c) Low price.

Whereas, from the manufacturer's perspective, they are of

d) High volume,

e) Low margins,

f) Fast turnover.

(Majumdar, 2006)

Simply put, FMCG products are cheap, accessible and short-lived products made to meet the consumers' everyday needs. Unlike high value product sectors such as automobile, housing, or electronics, FMCG products require lower investments of money and time both from manufacturers and consumers. It results in a lighter-minded attitude towards the potential impacts of the industry. However, the sector has direct anthropogenic impacts on the environment and society; natural resource

depletion, greenhouse gas emission, and waste generation are all examples of the conspicuous impact throughout their product's mundane life cycle (Bocken *et al*., 2011). The environmental impact of this sector is substantial. For example, approximately 80% of products go to the landfill after a single use, and over 90% of them are within six months (Hawken, *et al.,* 2013). Also world's 10 biggest food and drink brands create more greenhouse gases than the total emission of all Nordic countries (Oxfam, 2014).

Implementation of sustainable design in FMCG can help make a positive change. Nonetheless, the FMCG sector is surprisingly understudied within sustainability research, and few industrial practices offer empirical evidence at a major scale. Petala *et al*.'s empirical study (2010) is a rare example in which Unilever was studied. They examined the challenges for incorporating sustainability using the content analysis method on 202 NPD briefs within their food product projects. They found that incorporating sustainability in the NPD briefs did not guarantee results. Their findings also confirmed a number of factors Boks (2006) has touched upon in regard to clear internal communication, tailor-made eco design tools, clear environmental target, senior management commitment, and cross-functional teamwork. Although this study is significant in that it addresses the understudied FMCG sector, it is limited to a single case study of one company relying only on content analyses of project briefs. This makes the resulting insights difficult to be transferred to the larger FMCG context.

2.5 Influencing factors of sustainable design implementation

This section scrutinises the influencing factors for sustainable design implementation in previous researches across different epistemic communities.

A number of empirical and discussion-based studies exist within the sustainability literature with a focus on the success factors and barriers for sustainable design implementation. Findings of these studies have a number of meaningful features to

consider which can be categorized under different contextual levels: organizational, operational, and managerial.

Lenox and Ehrenfeld (1997) conducted one of the first in-depth studies from the organizational perspective. They consider the environmental design capability as a direct indicator of a company's environmental capability. Through in-depth case studies of four multi-divisional electronics firms, they propose *knowledge resources, communicative linkages*, and *interpretive structure* as the roots of environmental design capability.

Another study at the organizational level is by van Hemel (1998). Since her study is confined to the SMEs in the Netherlands (albeit being extensive to cover 77 firms) the contextual difference yields contradicting results to the former study. *Motivation* is the main finding while internal communication is less important. In addition, *innovative approach, a positive attitude to eco design,* and the c*ommercial opportunity of an eco design project* are suggested as being unique to SMEs.

Secondly, at the operational perspective, building upon the three points made by Lenox and Ehrenfeld (1997), Simon *et al*. (2000) identify five critical factors for success in eco design as follows:

a) Initial and sustained motivation,

b) Communication,

c) Whole-life thinking,

d) Hands-on eco design,

e) Position in a competitive market.

While Lenox and Ehrenfeld's three points are at the organizational level, Simon *et al*. provide a closer view at the operational level when an NPD team is applying eco design into practice. The research is based on the Design for Environment Decision Support (DEEDS) project (McAloone and Evans, 1997). The DEEDS project is one of the first full-scale studies to examine how product development practice eco design, based on the

strong empirical qualitative data from over 100 practitioners within 19 major electrical and electronics manufacturers in UK, USA and continental Europe.

Luttropp and Lagerstedt (2006) propose 'ten golden rules' for eco design at the operational level. The rules act as general assessment criteria for implementing eco design, an education tool for future generations, and guidance to designers.

Lastly, from the managerial perspective, Ritzen and Beskow (2002) claim that managerial encouragement of individual participation enhances success in implementing environmental aspects into product development. This research is especially beneficial for those companies that are presently non-practising but willing to start adopting. They suggest following suitable actions for radical integration of environmental criteria such as:

a) Clear management actions and strong signals to give practical guidance,

b) Promote active individual participation in integration activities,

c) Develop formal work procedures clearly indicating and demanding environmental efforts,

d) Implement support tools, selected and implemented with care of procedural approach,

e) Develop individual competence, product developers "to know", specialists "to act",

f) Secure knowledge sources applicable to product development teams.

Johansson (2002) collates the success factors for integration of eco design in product development through synthesizing literature from 1990 to 2000 (Table 2.1). His literature review is perceived as the most extensive coverage of success factors (Boks, 2006). He classified 19 factors under six different areas.

One of Johansson's noticeable observations is:

> *"to a great extent many of the important elements for NPD are generally claimed to be the same for the integration of eco design*" (p.105).

Four out of six areas such as management, customer relationship, supplier relationship, and development process are common success factors areas in both product development and eco design integration; while competence and motivation are specifically unique to the latter. As he covers a number of important elements and issues, an empirical validation is necessary to follow as a next step. However, the list of success factors in Table 2.4 lacks several factors which other research has identified as important, such as communication.

Table 2.4 Success factors for integration of eco design in product development (Johansson, 2002)

Area of concern	Success Factors
Management	Commitment and **support** are provided Clear environmental goals are established The environmental considerations are addressed as business issues Not only the operational dimension of eco design should be considered, but also the strategic dimension
Customer relationships	A strong customer focus is adopted Companies train their customers in environmental issues
Supplier relationships	Close supplier relationships are established
Development process	Environmental issues are considered at the **very beginning** of the product development process Environmental issues are **integrated** into the **conventional product development process** Environmental checkpoints, reviews and milestone questions are introduced into the product development process Company-specific environmental design principles, rules and standards are used Eco design is performed in **cross-functional** teams Eco design support tools are used
Competence	Education and training are provided to the product development personnel An environmental specialist supports the development activities Examples of good design solutions are utilized
Motivation	A new mindset emphasizing the importance of the environmental considerations is established An environmental **champion** exists Individuals are encouraged to take an active part in the integration of eco design

In 'The soft side of eco design', Boks (2006) identifies success factors and obstacles in eco design from the literature and validates them. In his literature review section, his

references include the table in Johansson's study mentioned above. His research shows that the main success factors for implementation of eco design are the same as the conventional business aspects such as:

a) Customization,
b) Organization,
c) Senior management commitment.

On the other hand, the most serious obstacles are attributed to socio-psychological issues like:

a) Gaps between proponents and executors,
b) Organizational complexities,
c) Lack of co-operation.

Notably, his study dissents a number of literature findings through his empirical interview analysis. Some of his low-ranking elements have been highly acclaimed in previous studies. The existence of sustainability champions and eco design tools are examples of such cases. Rather, he argues the importance of the soft side: emotional, sociological and psychological aspects as well as communication between horizontal teams. His article carries a good number of astute analyses of the status quo in the sustainable design research. However his validation is inherently restricted to the particular context of Far East Asian electronic firms. In this study, his findings will be scrutinized to compare the common or conflicting results within the FMCG context.

de Medeiros *et al.* (2014) lately conducted a systematic review of success factors for environmental sustainability encompassing five disparate research areas: business, management, economics, finance, and engineering. From 32 related journals, they have traced 433 articles, then 2580 articles, and finally narrowed them down to 67 relevant papers. The result is the analysis of five research dimensions: marketing, internal organizational factors, product development and management, business management perspective, and knowledge management.

The synthesis of their review findings is presented in Table 2.5.

Table 2.5 Synthesis of critical success factors and its constituent elements for environmental sustainable innovations (de Medeiros *et al*. 2014)

Factors	Variables
Market, law and legislation knowledge	• Customer expectation fulfilment • Knowledge about factors that drive sustainable buying • Comply with laws and regulations • Competitor monitoring • Financial or information support from government • Knowledge about cultural variables that influence buyer behaviour • Knowledge about consumption patterns of reference persons
Interfunctional collaboration	• R&D, marketing and production integration • Stakeholder integration (suppliers, universities, environment specialists, etc) • Cultural predisposition towards collaboration
Innovation-oriented learning	• Development of a set of green competences (proactivity, creativity and experimentation) • Development of critical reflective analysis capability • Elimination of cultural barriers
R&D investments	• Investment on / adoption of methods for sustainable product development • Investment in qualified human resources Investment in cleaner technology research • Investment in R&D infrastructure

It is perceived as the most thorough and systematic review of the latest research progress, and the findings cover micro and macro aspects of sustainable product innovation. Although extensive, the review overlooks the subtle differences among sectors and regions, as they do not consider such separations. However, this review offers a meaningful consolidation of today's sustainability research, and detailed analysis into each factor allows a rich understanding of the subject area.

Cai and Zhou (2014) depict how external drivers and internal drivers affect ecodesign innovation performance. This study shed light on the less explored Chinese manufacturing context, analysing 1266 datasets from Chinese manufacturing firms. In this study, the internal drivers are listed as technological capabilities, organisational capabilities, and CSR, whilst the external drivers are environmental regulations and customers' green demands. Their new insights are:

a) External drivers affect eco-innovation partially through internal drivers,
b) Integrative capability partially mediates between drivers and eco-innovation performance,
c) External network strength moderates between external drivers and integrative capability.

2.6 Barriers

This section deals with identified barriers for sustainable design implementation. Section 2.6.1 consolidates the existing research on barriers whilst Section 2.6.2 to 2.6.5 render newly observed barriers identified from related literature.

2.6.1 Product development environment

Summarizing a number of previous studies, Murillo-Luna *et al*. (2011) identify barriers under the categories of external and internal barriers (Table 2.6).

Table 2.6 External and internal barriers to the adoption of proactive environmental strategies (Modified from Murillo-Luna *et al.*, 2011)

External Barriers	Internal Barriers
Scarcity of information	Lack of **financial** capabilities
Inadequate industry regulation	Lack of **organisational** capabilities
Rigidity of legislation and bureaucratic complexity	Lack of **strategic** capabilities
Limited development of environmental **supply sector**	Limited motivation and preparation of the **employees**
High cost of environmental services/ technologies	Operational **inertia**
Difficulties derived from **competitive pressure**	
Priority of other external matters or requirement	

Lee-Mortimer and Short (2009) conducted an empirical research on adoption of design for sustainability (DfS) within SMEs in the UK. The list of the hindrance includes a) *culture, b) rigidity of approach,* and c) *a lack of structured 'good' practice*. In conclusion, the product development 'environment' is consolidated as the main roadblock, which can encompass all the previously identified barriers including:

a) Misperception of responsibility,
b) Unclear environmental benefits,
c) Unavailability of alternative solutions,
(van Hemel and Cramer, 2002)
d) Relatively short-time horizons for major investment decisions,
e) Overestimated importance of realized efforts on environmental, improvement
f) Immature internal management structures for the identification of sustainability opportunities,
g) Insufficient knowledge.
(Keijzers, 2002)

2.6.2 Misalignment between NPD and sustainability process studies

A thorough review of design process models reveals a misalignment between businesses' conventional NPD process (i.e. Stage-Gate Model®) and the academic sustainable design processes. Baumann *et al.*'s review (2002) of 650 articles across disciplines including engineering, management, and policy studies analyses that the *absence of a systemic view* is attributed to the misalignment between the new environmental process models and the conventional process.

The lack of a systemic view often results in restricted and fragmented studies that are only valid within a part of the product development process, or under certain conditions. Figure 2.3 reveals the discrepancy between proposed processes by various

authors. The author's initial attempt (dotted vertical lines) to align a number of suggested process diagrams fails to show any matching stages with one another.

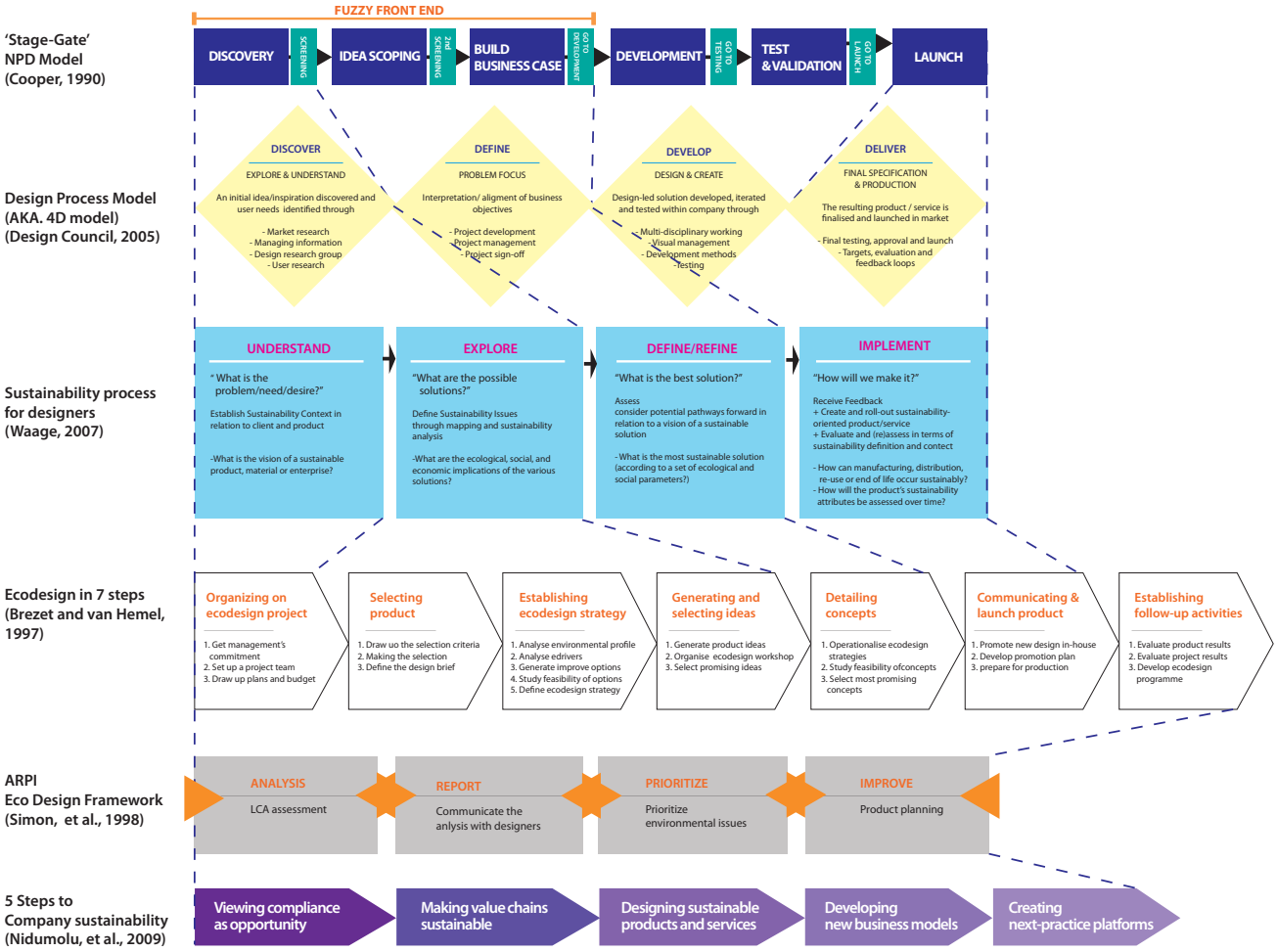


Figure 2.3 Misalignment in different sustainable design processes

'Stage-Gate Model®' on top serves as the baseline as being the conventional NPD process, which many companies use with varying number of stages from four to seven (Cooper and Kleinschmidt, 1994). Nonetheless, following diagrams (descending order from the top) including *4D Model* (Design Council, 2005), *Sustainability process for designers* (Waage, 2007), *Eco design in seven steps* (Brezet and van Hemel, 1997), *ARPI framework* (Simon *et al*., 1998) and *five steps to company sustainability* (Nidumolu *et al*., 2009) either omit certain stages or concentrate on one stage, or place stages in a different order. For example, the 4D design process model, second from the top, which

the Design Council has coined in 2005 shows little evidence of contextual consideration of existing NPD process. Because it focuses on illustrating the unique thinking process of design activities through diversions and conversions via diamond shaped configuration, it can hardly be fitted with the NPD model.

Waage's (2007) study *Reconsidering Product Design* and *Sustainability process for designers* is criticized by Goffin (2012) as follows,

> *'proposing a completely new process of integrating sustainability into NPD is ignoring the very comprehensive body of the NPD knowledge of past several decades from research and practice'*(p.112).

One may argue that the ARPI framework (Simon *et al*. 1998) has slightly different characteristics from the rest of the framworks as it is an iterative conceptual framework with no intention to be used in a linear fashion. The ARPI framework is based on the DEEDS project that specifically focuses on the practical benefits to the electronic and electrical industry. But ARPI has no specification of sector types it would be applied best. The authors believe that the framework can be applicable to any other design project across the design field in industry, which strongly risks overgeneralization. Brezet and van Hemel (1997), the inventors of the *Seven steps to eco design* claim that the basic structure of product development process does not change when integrating environmental requirements. They introduce a step-by-step eco design implementation process, but its narrow focus of eco design does not provide a comprehensive structure that can be adopted easily by NPD managers. Meanwhile, the *five steps to company sustainability* by Nidumolu *et al*. (2009) is developed for a corporate level rather than in an operational level context.

Overall, Figure 2.3 shows the discrepancy between what industries normally do and what academic research is providing. Thus, one can imagine the frustration that industry practitioners face from the misalignment. Even if they attempt to start embedding sustainability into their practice, they become discouraged by the difficulty of fitting the newly invented wheel into their conventional car.

2.6.3 Mixed use of sustainable design terminology

Environmentally focused design has been an issue among designers for more than a century. William Morris as early as in the 1890s, Buckminster Fuller in the 1930s, and Victor Papanek in the 1970s are notable pioneers of 'environmentally responsible design' (Fletcher and Goggin, 2001; Boks, 2006).

Various terms have been used to describe these movements from green design, eco design, design for the environment, whole system design, and sustainable design, to name a few (see Appendix A). After Mebratu's (1998) thorough summary of the vague concepts of sustainable developments, Glavic and Lukman (2007) collected the relevant terms under a hierarchical classification of 51 sustainability terms and definitions. They reveal that the established definitions are so non-specific that they provide the cause of occasional misunderstanding. They claim that sustainable development should be supported by a common, unambiguous terminology. Charter and Clark (2007), Pascual *et al*. (2010), and Hallstedt *et al*. (2010) also agree on the importance of a clear terminology.

Notwithstanding these efforts for a more articulated terminology, unconsolidated usage of different terms is conspicuous both in academia and industry. Furthermore, a large number of researchers take the fuzziness of terminology rather lightly. While Brezet and van Hemel (1997) do point out that much confusion arises over terminologies, many others believe these different terms are more or less synonymous or interchangeable (Keoleian and Menerey, 1994; Madge, 1997; Argument *et al*., 1998; McAloone (a), 1998; Sherwin, 2000; Simon *et al*, 2000; Baumann *et al*., 2002; Lagerstedt, 2003; Jeswiet and Hauschild, 2004; Kurk and Eagan, 2008). In some cases, even while agreeing to a certain extent as to the confusion, some authors treat different design terms as one (Short *et al*., 2012).

However, are they really the same? Although they share a common goal at the core, each single term from 'green design', 'eco design', 'sustainable design', 'whole system design', 'design for the environment (DfE)', 'environmental conscious design', 'life cycle engineering' to 'clean design' has different nuances and practices (Lagerstedt,

2003; Bhamra, 2004). Ideally, these different terms embody distinguishing approaches on issues of scale, ease of implementation, potential environmental benefits, and the focus of design activity (Fletcher and Goggin, 2001). The transition form 'green' to 'eco' to 'sustainable' represents a steady broadening of scope, and an increasing critical perspective on environment and design (Madge, 1997; Baumann *et al.,* 2002).

Firstly, the term 'green' appeared in the 1970s with the birth of environmental action groups such as *Greepeace* or *Green party*. Green design is at the bottom of the hierarchy of the environmentally focused design terms as it has been the first wave of the movement. It has a limited environmental benefit due to its focus on a single environmental issue (Bhamra and Lofthouse, 2007). Dewberry and Goggin (1996) also state that green design has a single focuses, e.g. use of recycled material, recyclability, or energy efficiency.

Secondly, shortly after green design, eco design emerged in the late 1980s and early 1990s. Its origin is from the term 'ecology' associated with the life cycle approach, tackling all impacts across the product's life cycle (Dewberry and Goggin, 1996). To compare how others have defined it differently, Karlsson and Luttropp defined eco design as "design in and for a sustainable development context" (2006) while Charter and Tischner (2001) remarked as "sustainable solutions that are products, services, hybrids or system changes that minimize negative and maximize positive sustainability impacts throughout and beyond the life cycle of existing products or solutions, while fulfilling acceptable societal demands/needs'' (2001). A few years later Park and Tahara (2008) defined it as "an activity that identifies the environmental aspects of a product and then integrates them into the product design process in the early stage of the product development process". They added function, cost, performance, quality, and legal and technical aspects as considerable factors during the eco design process.

Thirdly, 'sustainable design' was born when the term 'sustainable development was introduced in the *Brundtland Report, our Common Future by the World Commission on Environment and Development* in 1987 in the following well know words: 'development that meets the needs of the present without compromising the ability of

future generations to meet their own needs.' Sustainable design embraces a widened context that extends from only environmental protection in the past to societal balance and economical advantage (Bhamra and Lofthouse, 2007). It encompasses a broader, holistic approach including questioning/ addressing needs, concern for ethics and equity, services and leasing, dematerialization, empowerment, caring and sharing, as well as eco design best practice (Dewberry and Goggin, 1996). The inclusion of society and economy as well as the environment is a distinguishing point of sustainable design (Triple bottom line, Elkington, 1998). In this research the definition by Bhamra and Lofthouse (2007) based on ECO2-IRN (1995) is adopted (Section 2.2). An extensive consolidation of various definitions of 'environmentally focused design' is presented in Appendix A.

The terms also vary according to the field where they were originally conceived. For example, 'design for the environment' or 'eco design' are prevalent in engineering whilst 'life cycle design' is developed from environmental sciences, and 'sustainable design' or 'design for sustainability' are from the industrial design field (Bhamra, 2004). From another perspective, DfE is commonly used in USA whereas eco design is more common in Europe (Baumann *et al*., 2002; Kurk and Eagan, 2008; Short *et al*., 2012).

Centred on the idea of design for sustainability (DfS), Arnette *et al.* (2014) combined the disparate Design for X (DfX) approached into a single taxonomy based on 122 studies ranging from 1983 to 2012. The classified DfX considerations and the relationship between subcategories shown in graphical format enables designers avoid confusions, and pursue efficient ecodesign strategies at different product life cycle phases.

In the following empirical phase of this study, the most commonly used terminology, and typical design emphasis will be explored among managers, designers and relevant stakeholders in the FMCG context.

2.6.4 Mixed use of system terminologies: Model, framework and theory

Following the mixed use of sustainable design terminologies, another confusion factor in general research is highlighted in the mixed usage of the system terminologies: *conceptual model, framework,* and *theory.* While numerous researchers present a unique set of conceptual device in pursuit of describing or explaining certain phenomenon, the system terminologies are used without a clear set of agreed definitions.

Appendix B consolidates possible definitions and criteria from literature for selecting appropriate terminology under a consolidated form by prevalent researchers along with the dictionary definitions. Establishment of a set of clear definitions lessens the level of confusion and consequently lowers the barriers of clear adoption of academic research into industry.

A conceptual research by Anguita *et al*. (2008) offers an illustrative instance of mixed usage of system terminology without any clear definitions. They develop a sustainable decision-making device and use the terms framework, model and process to describe it. They start by calling the figure a 'framework' then 'model' for most of the time, then sometimes a 'process'. "*In this wider framework... this process can be... using the model...*" (p. 162).

Researchers agree that there are many different terms and definitions, and it causes substantial misunderstandings between academics, industry, managers and designers, consequently slowing down the adoption of the purported concept or practice. However, many still take the terminology issue rather trivially, and not enough attempts are made to neither reconcile nor measure the level of the confusion. In other words, a proactive effort has to be made to resolve the confusion. In this research, the confusion around the sustainable design terminology is empirically investigated, and the system terminology is articulated in the suggestion of a conceptual framework in Section 6.3.

2.7 Success factors

This section lists the success factors identified by the review of sustainable design literature, and the front-end NPD studies. Sections from 2.7.1 to 2.7.4 present common success factors from both areas, whereas, Section 2.7.5 to 2.7.7 discuss the controversial factors.

2.7.1 Senior management support

Not only by providing financial and human resources, but also by providing clear vision, motivation, and 'top-down' pressure, senior management plays an important role in successful implementation of sustainable design (Lee-Mortimer and Short, 2009). In order to achieve sustained motivation for eco design integration, McAloone and Evans (1999) believe that the primary step is to gain top management understanding and commitment. In other words, the senior management is critical in the strategic consideration of sustainability.

Lack of senior management support is a major barrier to implementing sustainability efforts in companies (Willard, 2005; Hallstedt *et al*., 2010). Hallstedt *et al*. specifically look into the senior management and product development level under the prerequisite that decisions about sustainability and other long-term strategic challenges are naturally taken at the senior level. They conducted six case studies in search of a new approach to assess company decision systems regarding sustainability-related communication and decision support. The four major findings are:

a) Senior management should relate *long-term strategic sustainability challenges* to *short-term tactical business challenges*: including long-term sustainability issues in the senior management decisions without hindering competitiveness in the short term,

b) Senior management should have a systematic *incentive and monitoring* systems to facilitate implementation of sustainability measures: without the integration of a defined sustainability objective into concrete business goals, followed by general sustainability awareness education, and incentive/disincentive systems (allocation of time, money, and staff) implementation is unlikely take place,
c) Companies should have a *standardized 'toolbox'* for sustainability-related information in decision processes: a systematic approach to
    - acknowledge and understand the sustainability problem,
    - generate possible solutions/ innovations in relation to the understanding,
    - communicate between organizational levels through a common 'language/terminology',
    - implement prioritized solutions and follow up on their efforts.
d) Senior management should adopt a *proactive attitude* in utilizing *tools* and methods, and giving appropriate training to use them.

Managerial practices promoting the participation of individuals enhance the chances of successful change within companies (Epstein and Roy, 2001; Ritzen and Beskow, 2002). In order to achieve maximum sustainability performance, management should send a clear message that sustainability is important for the company. Specifically, incentive through evaluation and rewards should be established to encourage excellence (Boks, 2006). In the general NPD perspective, senior management is to provide general guidance of product strategy, portfolio plans, and project resource plans (Khurana and Rosenthal, 1998; Kim and Wilemon, 2002). Most recently, Felekoglu and Moultrie (2014) conducted a systematic literature review of top management involvement in NPD, synthesising 46 studies during last 40 years. With the rich evidence to support, they claim the critical role of the top management.

2.7.2 Internal communication

The importance of communication at different levels, context and content are emphasized several times (McAloone and Evans, 1999; Johansson, 2002; Boks, 2006; Petala, 2010). Structured communication is one of the most critical means of achieving efficiency and effectiveness not only for the sustainable NPD but also for the general NPD (Khurana and Rosenthal, 1998; Kim and Wilemon, 2002; Johansson, 2002). Lenox and Ehrenfeld (1997) articulate interpretive structures as crucial for understanding and valuing the environmental information as well as dense information network, i.e. communication linkages. The level and content of communication vary from operational [i.e. communication of the environmental analysis results for designers (Simon *et al*., 2000)] to managerial [i.e. communication of the environmental information between teams (Stoyell *et al*., 1999)]. Johansson (2002)'s view is at organizational and operational levels; 'frequent internal communication builds team cohesion and reduces misunderstandings and barriers to interaction, whereas frequent external communication opens the project team to new information that can be useful in the NPD.' Although van Hemel (1998) finds internal communication much less important in SMEs of less than 200 employees, communication is still a considerable factor for the FMCG sector at various levels and approaches. Tien *et al*., (2005) advocate that the better the communication with environment-related interest groups, the greater the degree of environment-related knowledge acknowledgement, the greater the degree of innovation and the higher the degree of environmental design implementation. Although they drew the conclusion that there is no noticeable impact on environmental design and business competitive advantages between the industry group and enterprise scale variables, as their study samples are solely based on Taiwan's cross-sectorial industry, regional variables could be considered for future research.

A notable research by Verhulst and Boks (2012) about human factors in sustainable design implementation cluster 20 constructs under three subcategories of internal communication (i.e. seven under *involvement and empowerment*, five under *process supporting tools*, and eight under *spreading of information*). Their research certainly

shows several similarities in terms of the topic, methodology and approach with present research. On the contrary, some differences are apparent in regards of the subject perspective, and sample case context. Their view that is specifically focusing on human aspects from change management perspective legitimately lists a wide variety of elements underneath it. As one of two overarching human factors, they position internal communication as an overarching theme that embraces several factors that are treated individually in present research (Highlighted in grey in Table 2.7):

Table 2.7 Overview of communication methods and tools (Verhulst and Boks, 2012; Verhulst, 2012)

	Communication methods and tools
Involvement and empowerment	Believers Core team Direct communication / internal network Steering committee Regular meetings / community or committee Ambassadors Adapted information / communication style per department
Process supporting tools	Example products/ projects Pilot projects Guidelines, checklists, templates, etc. Database External consultant
Spreading of information	Own label Existing labels and framework Items in internal firm magazine / newspaper Item on intranet Dedicated mailings Dedicated presentation/ seminars Dedicated training/ workshops sessions Dedicated brochure

However, the present study takes a different approach from theirs, and gives similar weight to each factor for more detailed view into each of them. Verhulst's completing study (2012) following Verhulst and Boks (2012) (see Section 2.7.2) presents a complex visual model that depicts the sustainable design implementation process stages, and weaving four human factor clusters into them.

2.7.3 Cross-functional team

Since the beginning of sustainability studies, the importance of cross-functionality has been recognized and asserted. In order to create sustainable production in a complete chain, various disciplines have to collaborate simultaneously in a 'concurrent engineering' manner. A cross-disciplinary team benefits by making design decisions regarding environmental attributes (de Ron, 1998; Stoyell *et al*., 1999). Similarly, McAloone (1998) claims that environmental issues cannot be dealt with fully at one specific point in the design process unlike manufacturing or assembly. A whole-life approach that questions each stage of the design process with cross-disciplinary members of the organisation is needed. In other words, the importance of cross-functional team is most evident when a team assembled of different competencies is able to approach the development task holistically (Johansson, 2002; de Medeiros *et al*., 2014). Gmelin and Seuring (2014) emphasise focusing on the product lifecycle in collaboration. Forming cross-functional team is also deeply related to intense communication within organisations (Gmelin and Seuring, 2014). Similarly, NPD research stresses the cross-functionality as it involves R&D, manufacturing, marketing, and quality control team responsible for key activities (Cooper and Kleinschmidt, 1991; Khurana and Rosenthal, 1998; Kim and Wilemon, 2002; Cooper, 2008).

2.7.4 Corporate culture for sustainability

Aforementioned subject such as *soft sides* by Boks, or the *environment* by Lee-Mortimer and Short can be grouped as corporate culture. It is an overarching concept that embraces all the soft factors within the company. One of the early definitions of corporate culture was made by White (1984) as '*behaviour patterns and standards that binds an organisation together*'. In his conceptual management study he lists characteristics of corporate culture as follows:

a) Encompasses everything an organisation does and makes,
b) Affects the managers' managerial manner, and consequently shapes employee behaviour,
c) Affects the organisation processes, and its product and provides services to customers,
d) Influenced by its beliefs,
e) Tells the employees what is right, what is wrong, what (not) to believe, how to react and how to feel,
f) Tells employees whether to focus on quantity or on quality,
g) Most strongly influenced by the leaders.

Based on a review of over 100 studies in organisational behaviour, sociology, and anthropology, Deshpandé and Webster (1989) defined corporate culture as *'the pattern of shared values and beliefs that help individuals understand organisational functioning and thus provide them with the norms for behaviour in the organisation'.* In 1999, Hankinson and Hankinson tried to give a shorter definition as, 'a company's overall philosophy, a set of values and beliefs that shape the way people think and behave'. They categorise corporate culture into three levels:

a) Level one: Visible artefacts, e.g. corporate logo, dress code, and annual events and ceremonies,
b) Level two: A company's underlying values and beliefs e.g. sharing new ideas, working practices, corporate responsiveness,
c) Level three: Translation of values and beliefs into learned behaviour.

They argue the importance of corporate culture lies in its encouragement for managers to act in ways that employees can understand and predict, therefore the strategic effects on the way brands are managed in long-term. Most recently, from their longitudinal empirical studies on the success factors of six European corporates, Sackmann and Stiftung (2006) define corporate culture as 'collectively held basic beliefs, which determine the company's general orientation'. They claim corporate

culture as a critical element for a firm's success. Summing up the above three definitions, belief and behavioural patterns are the key components of corporate culture. Six are chosen out of ten key dimensions of corporate culture by Sackmann and Stiftung (2006) to be relevant to this study in terms of corporate culture of sustainability. The six dimensions including transparency, legacy, behaviour, belief, structure and citizenship are empirically tested within this study.

2.7.5 Consumer involvement[3]

Consumer involvement is another common factor both from the sustainable design research and the front-end NPD research. From sustainable design perspective, Johansson (2002) believes that a strong customer focus has to be adopted for a successful eco design implementation, and Short (2008) also claims that the starting point of any industry attempt to be 'sustainable' must be a proper understanding of the consumer,

> *"The sole way to ensure this is to ensure that products and product lines are able to sustain themselves and the only way to ensure this is to start with the consumer."* (p. 30)

In a similar vein, numerous front-end studies advocate the crucial role of consumer involvement (Cooper and Kleinschmidt, 1994; Khurana and Rosenthal, 1998; Kim and Wilemon, 2002; Eisenberg, 2011). Based on an empirical study of 103 new product projects within the chemical industry, Cooper and Kleinschmidt (1994) establish that building the consumer voice into the NPD process is one of the key factors in successful on-time product development. Building upon two principle concepts from previous studies, Bolton (2013) identified important factors for positioning user-centred design more effectively within the UK SMEs environment. His two key concepts such as a) *Users/ customers are the best source of ideas* (Herstatt and von

[3] In this study, 'consumer' represents 'customer' or 'user' in some texts, so does 'engagement', 'focus' with 'involvement'.

Hippel, 1992), and b) *Identifying user needs is an integral part of product design and development process* (Ulrich and Eppinger, 1995) are good examples of studies emphasizing the benefits of consumer involvement.

As the name of the sector i.e. *consumer* goods literally suggests, consumer is the focal point of the context of this study. Drucker (1954) asserts that the only valid definition of business purpose is to create a customer.

> "*The customer is the foundation of a business and keeps it in existence."* (p. 35)

Arguably, Drucker is the first author who scrutinised management, structure, and internal dynamics of a business corporation, and his pioneering insights are still actively referred to.

However, In respect of consumer-focus and sustainability, Sheth *et al.* (2011) witness the gap between sustainability and consumer focus, and suggested 'mindful consumption (MC)' as an avenue to ensure that business is both profitable and sustainable. They propose a framework of customer-centric sustainability (CCS), and the steps to take in 'mindful consumption (MC)' -oriented marketing as a critical mediating factor in translating marketing actions into CCS. MC helps matching customer's interest with business interest and provides sustainable solutions for both.

In this study, consumer involvement will be examined in terms of the various aspects relating to sustainability within the FMCG context.

2.7.6 Tools

Many of sustainability academics agree on the potential effectiveness of tools. Tools can be used as part of a systematic approach to cover areas like modelling and simulation of design and manufacturing, competition benchmarking, risk assessment, quality and/or environmental management systems, eco design and CSR (Hallstedt *et al*, 2010). As early in the 90s, Simon *et al*., published 'Eco design Navigator: a key resource the drive towards environmentally efficient product design (1998)'. This

yellow pages of eco design is a good example how much research has been done around the rear-end of the product development process with its compilation of 54 eco design tools and methods for industrial designers, engineers and product developers. In addition, in 2002, Baumann *et al*. identified more than 150 tools in the literature review. The types of the tools range from environmental checklists and guidelines, evaluation softwares, rating systems, analytical assessment (LCA: life cycle assessment), to operational frameworks. Even after the above compilation, constant attempts to create new tools have been made by James (1997), Robert *et al*. (2002), Anguita *et al*., (2008), Bocken *et al*., (2011), to name a few. Pigosso *et al*. (2013) recently developed the Eco design maturity model: a management framework to support eco design implementation into manufacturing companies. Such maturity models serve three main purposes:

a) Assessment of strength and weakness: descriptive tool,
b) Development of a roadmap for improvement: prescriptive tool,
c) Evaluation of the company, comparing to standard and best practices of other organizations: comparative tool.

Summarising most of available environmental tools added for ecodesign literature: ranging from 1995 to 2009, Bovea and Perez-Belis (2012) define three key factors necessary for optimisation of eco product design process. The factors are:

a) **Early integration** of environmental aspects into the design and development process,
b) **Life cycle approach** that takes how the product can affect the environment in its different stage into account,
c) **Multi-criteria approach** that simultaneously consider traditional requirements and relevant environmental aspects and impacts.

At the same time, many argue that too many tools have been developed whilst their dissemination is limited (Lenox and Ehrenfeld, 1997; Luttropp and Lagerstedt, 2006;

Short, 2008; Lee-Mortimer and Short, 2009). Judging from the literature, the engineer's research on eco design concentrates much on 'how to' methodologies, searching ways to generalize how to deal with the development of environmental design strategies, methodologies, and development techniques, or largely, tools. Tools are mainly applied at the development stage which is the rear-end of the whole NPD process. This stage has a higher level of measurability but a lower level of uncertainty than the front-end stages. Baumann *et al*. describe 'tool' as something 'used as shorthand for any systematic means for dealing with environmental issues during the product development process.'

The setback of concentrating on tool development lies in the following facts. One, no matter how many great tools and methodologies are developed, they are of no use unless they are supported through implementation by business and practitioners. Although a good range of support tools exists for various types of eco design activities, the adoption of these tools within industrial practice has generally been poor (Handfield *et al*., 2001; Baumann *et al*., 2002; McAloone *et al*., 2002; O'Hare, 2010). Lenox and Ehrenfeld argue "*All too often these design tools fail to consider the context in which they are to be embedded and consequently never see adoption*." (p. 195). Two, while there is nothing bad in developing new tools, the real problem is that there exists a far lower number of studies on user aspects and effectiveness in business than the conceptual publications describing their own tools. Too little linkage in the larger context has been conducted compared to the wealth of tool development (Boks, 2006). Researchers are more interested in developing a new tool than on studying the existing ones or on evaluating them for further implementation. However, fragmented research on tools for one or two areas fails to provide a holistic view to business practitioners. Consequently it contributes to the broadening of the chasm between academic research and industry practice. In fact, successful firms have not been heavily reliant on tools. Perhaps tools are not even necessary, they are just an aid to environmental management, after all (Eherenfeld and Lenox, 1997; Poole *et al*., 1999; Baumann *et al.*, 2002).

Nevertheless, Birch *et al.*'s (2012) analysis of 22 Design for Environment (DfE) tools under four different output mechanisms advocates the usefulness of tools. They shed light on the potential of tools and suggest to future direction. Tools need to move the focus from strategy to product in order to deliver more relevant guidance and effective outputs for products.

2.7.7 Project / sustainability champions

The sustainability (or project champion for NPD) champions is another subject that makes recurring appearances over a number of studies (Moenaert *et al*., 1995; Lenox and Ehrenfeld, 1997; Khurana and Rosenthal, 1998; McAloone *et al*., 1998; Simon *et al*., 2000; Kim and Wilemon, 2002; Johansson, 2002). Champions act as a source of expertise and channel of communication. They function as a technical focal point and tackle the unfamiliar issues concerning environmental criteria in design. This person should be enthusiastic and knowledgeable about the sustainability issues so that he or she motivates the team and make the information flow well. In order to ensure more effective communication within/ between teams and team members, the champion should be one of the designers and not an external member from the corporate's environmental department. Also, the concept of champion is found in the general management literature in the name of 'project champion'. Nevertheless, Boks (2006)'s empirical research debunks the importance of the champion. This may be attributed to the fact that there is no such person like 'sustainability champion' in his data sample. Verhulst (2012) (also in Verhulst and Boks, 2014) named this position as an ambassador in her thesis where she identified the human side of sustainable design implementation from change management perspective. The ambassador is under the category of human empowerment. Empowerment is argued to lower resistance against change within organisation, and support the change process (Verhulst and Boks, 2014).

2.8 Consolidation of factors

The review identified and compared the factors that influence the implementation of sustainable design at the front-end of NPD**.** Table 2.8 consolidates the literature findings and compares the *factors that influence successful sustainable design implementation* with *the factors that influence successful front-end innovation*. In Table 2.8, the far left column lists the factors found in the previous research across a number of research areas.

These factors are divided into two groups: common factors and controversial factors. Common factors represent the factors that are commonly found both in sustainable design literature and front-end NPD/ innovation literature. Controversial factors represent the factors that are disputed.

First, the review reveals that many of the influencing factors for sustainable design and front-end encompass one another and share commonalities. Senior management support, internal communication, cross-functional team, and supportive corporate culture are the success factors that penetrate different research areas. The second and third left columns in Table 2.8 respectively represent the attributes of the factors and the authors who claim them within the sustainable design field. These attributes are found to be argued in front-end NPD studies (Two columns in the far right).

Second, existence of project/ sustainability champion, usage of tools, consumer orientation, formalised structure are controversial factors. Sustainable champions (project champion for front-end NPD) is claimed as a success factor by many authors from both sustainable design and front-end studies (e.g. Lenox and Ehrenfeld, 1997; Simon *et al.,* 2000; Kim and Wilemon, 2002), but Boks (2006) says such a person did not even exist in his sample cases. Similarly usage of tools is another controversial factor to which some of the sustainable design authors claim its uselessness (e.g. Simon *et al.,* 2000; Lee-Mortimer and Short, 2009). Consumer orientation and formalised structure are also claimed to be necessary by the front- end NPD academics, while some sustainable design authors disagree of its necessity.

Table 2.8 Common and controversial factors for sustainable design implementation and front-end innovation

	Sustainable design implementation		Front-end innovation	
	Attributes	**Authors**	**Attributes**	**Authors**
Common Factors				
Communication	Vertical / horizontal (Within / between teams) Interpretive structures	Lenox and Ehrenfeld (2000) Johansson (2002)	Among R&D, engineering and marketing	Khurana and Rosenthal (1998) Kim and Wilemon (2002)
Senior management support	Financial back-up: budget / resources allocation Motivation Incentive Clear vision	Ritzen and Bestow (2002) Boks (2006) Lee-Mortimer and Short (2009)	Matching core team capabilities to the role played by senior management	Moenaert *et al*. (1995) Khurana and Rosenthal (1998) Kim and Wilemon (2002) Goffin (2012)
Cross-functional team	Critical decisions at early stages	Borsboom (1991) de Ron (1998) Stoyell *et al*. (1999) Johansson (2002)	Horizontal cooperation	Cooper and Kleinschmidt (1991, 1995) Khurana and Rosenthal (1998) Kim and Wilemon, (2002) Cooper (2008)
Corporate culture	Supporting sustainable goals by individuals and corporate	Lee-Mortimer and Short (2009)	Collaborative culture	Murphy and Kumar (1997) Khurana and Rosenthal (1998) Kim and Wilemon (2002)
Controversial Factors				
Sustainability (project) champions	Knowledgeable, inspiration, motivated individual ** Doesn't exist	Lenox and Ehrenfeld, (1997) McAloone *et al*., (1998) Simon *et al*. (2000) Johansson (2002) Boks (2006)	Project owners: help drive the front- end give breath and scope	Moenaert *et al*. (1995) Khurana and Rosenthal (1998) Kim and Wilemon (2002)
Tools	Customized tools ** No use	Simon *et al*. (2000) Luttropp and Lagerstedt (2006), Short (2008)	Appropriate tools	Schilling and Hill (1995)
Consumer orientation	Consumer focus Consumer education **No need	Johansson (2002) Short (2008)	Emphasize consumer involvement	Khurana and Rosenthal (1998) Kim and Wilemon (2002)
Formalized Structure	EMS (Environmental Management Systems) ** Necessary but not sufficient	Simon *et al*. (2000)	Formalized systems Managing the interface functions and departments	Khurana and Rosenthal (1998) Kim and Wilemon (2002)

2.9 Summary of literature review

This section summarises the systematic review of literature from various research communities encompassing industrial design, engineering design, sustainable design, the NPD front-end studies, and corporate social responsibility (CSR) studies from the management research.

The review has highlighted that despite the repeated evidence suggesting that sustainability should be considered as early as possible within the NPD process, a significant lack of research exists to prescribe how this should be done. Hence, the scope of this research is placed at the understudied and underutilized area: the sustainable design implementation at the front-end of the NPD process.

To further extend and validate these insights, an empirical study follows to look into each factor in turn. In addition, identified potential barriers including mixed use of sustainable design terminology will be examined.

3. Methodology

This chapter sets out the research methodology of this study. The three stages of the research method consist of preliminary study, research design, data collection and analysis. The rationale for selecting the research methodology is provided along with the research questions that this study addresses. The ethical considerations and the limitations of the chosen methodology are presented.

3.1 Three stages of research activities

This section introduces the sequence of this study: Stage 1 was conducted in iteration with Stage 2 and 3, while Stage 2 preceded Stage 3 (see Figure 3.1). The three stages are:

Stage 1) preliminary study,

Stage 2) research design (see Table 3.1),

Stage 3) data collection and analysis (see Figure 3.3).

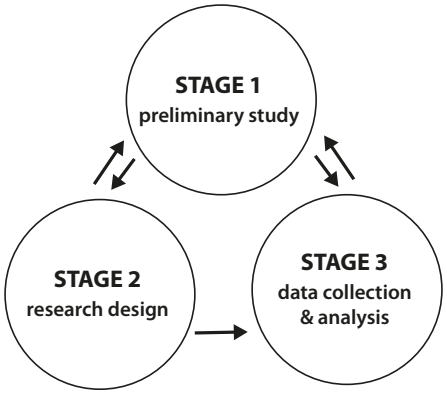


Figure 3.1 Sequence of research activities

The details of each activity are illustrated in Figure 3.2.

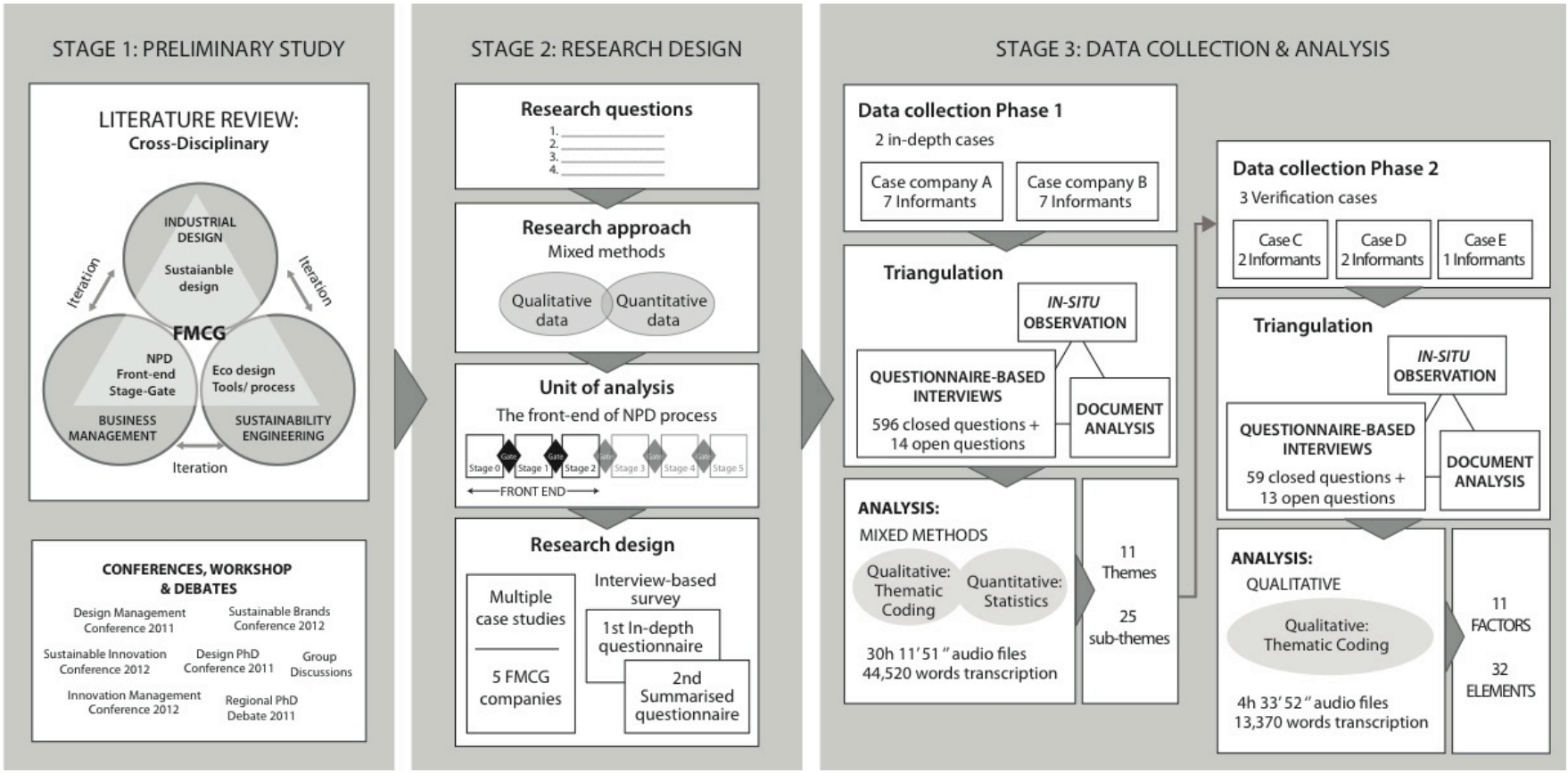


Figure 3.2 Research sequence (detail)

Stage 1) The *preliminary study* provides the background knowledge and rationale for the aim of the study. The first year and half of this research was intensively dedicated to this part, but it became an on-going iterative process throughout the study. Firstly, a systematic cross-disciplinary literature review was undertaken to gather holistic insights from various research fields surrounding sustainable design. The review encompassed three disparate research domains:

a) sustainable design innovation within industrial design research,
b) sustainable / eco design tools and process literature within sustainability engineering research,
c) front-end, NPD process literature within business management research.

Through an iterative and continuous process of reviewing literature throughout the study, the emergent themes were further developed and utilised to explain relationships between the constructs. Secondly, exploratory data was gathered through conferences, workshops, and debates. These activities laid the theoretical framework for Stage 2.

Table 3.1 Summary of research design

Unit of analysis	Front-end of NPD process
Research approach	Mixed methods
Data collection strategy	Multiple case studies
Context	The FMCG industry
Data collection method	Questionnaire-based interview *In-situ* observation Documents
Sample cases	5 FMCG companies from Asia, Europe and Latin America
Data collection sequence	2 In-depth cases 3 Verification cases
Data analysis strategy	Qualitative: Thematic coding Quantitative: Descriptive statistics

Stage 2) research design lays out the decisions made regarding research methodology (see Table 3.1). Research questions were first established and then fed into formulating the research approach. Also, based on the literature review, the unit of analysis was narrowed down to a specific part of the NPD process, namely the front-end. By doing so, a concrete research design was crafted consisting of multiple case studies and questionnaire-based interview. Next, selection criteria for case studies and the number of candidate case companies were established. Finally, a total of five FMCG case companies were chosen and allocated into two respective phases of data collection: a) two for the in-depth studies, and b) three for the verification studies. Two sets of standardized questionnaire were developed, accordingly.

Stage 3) data collection and analysis forms the main empirical outcomes of this study (see Figure 3.3). Data collection is divided into two phases: a) in-depth cases, and b) verification cases. For Phase 1 data collection for in-depth studies, two FMCG companies were examined through seven questionnaire-based interviews, *in-situ* observation, and document analysis, which allowed triangulation of the data. The collected data were analyzed using mixed methods: a) qualitative data: thematic coding, and b) quantitative data: descriptive statistics. The analysis yielded 11 themes (later renamed as factors) and 25 sub-themes (later renamed as elements), which was directly fed into the second questionnaire for subsequent verification studies. This research defines elements as the identified constituents particularly extracted under the current research context: *sustainability* and *FMCG*.

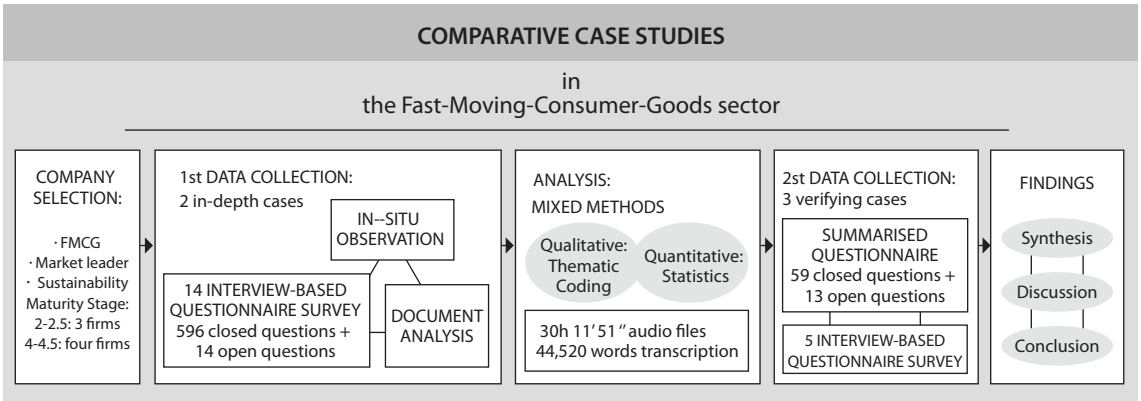


Figure 3.3 Two-phased data collection and analysis process

Phase 2 data collection for verification studies was undertaken in three FMCG companies. Data from five interviews in three cases was analyzed using qualitative data analysis. As the number of informants was too small for meaningful statistical analysis, quantitative data was not used. This phase shaped the final outcome of this study: 11 factors and 32 elements.

It is not possible to strictly demarcate the boundaries between Stage 1, Stage 2 and Stage 3, as these stages complemented each other in the course of the research. Especially, Stage 2 was constantly revised and supplemented by the findings resulting from Stage 1 and 3. Although Figure 3.2 shows three stages in the sequence format to give an overview of the research flow, it is an iterative framework as opposed to a linear chronological process. The details and rationale of selective components of each stage, i.e. the chosen research approach, and design are further explained in following sections.

3.2 Research paradigm: Epistemological considerations

This section introduces the philosophical assumption that underpins how the current research claims its contribution to knowledge. The epistemological position of a research brings to the researcher a lens for choosing their research process and data collection methods. The position fundamentally influences how they view and make sense of the social world as a social science researcher (James and Busher, 2009).

The classifications and specificities of paradigms vary from author to author. For example, Alvesson and Sköldberg (2000) categorise the paradigms into *positivism, social constructivism*, and *critical realism*, suggesting *critical realism* as an incipient alternative to positivism and social constructivism. Meanwhile, Guba and Lincoln (1994) list up four paradigms as *positivism, post-positivism, critical theory*, and *constructivism*, interpreting *critical realism* as ontology of *post-positivism*. Creswell (2003)'s more radical classification sets out *post-positivism* (grouping together with

positivism), *constructivism, advocacy/participatory,* and *pragmatism*, and includes *critical theory* into the *advocacy/ participatory* category. Guba and Loncoln (1994) are one of the authors who appreciate both qualitative and quantitative research in their approach to different social science research paradigms. Their interpretation of basic beliefs of four alternative inquiry paradigms are presented in Table 3.2 in terms of ontology, epistemology and methodology.

Bryman (1984) argues against the typical polarisation of paradigms around two major alternatives in the development of social science; namely positivist (empiricist) versus interpretivist (constructivist), by saying that positivists (empiricist) are often considered as having the same fundamental approach as quantitative research, and interpretivist (constructivist) as qualitative. Guba and Lincoln (1994) claim that both qualitative and quantitative methods may be used appropriately with any research paradigm.

Table 3.2 Basic beliefs (metaphysics) of alternative inquiry paradigms[4] (from Guba and Lincoln, 1994)

	Positivism	**Post-positivism**	Critical Theory et al.	**Constructivism**
Ontology	Naïve realism- "real" reality but apprehendable	Critical realism- "**real" reality but only imperfectly and probabilistically apprehendable**	Historical realism- virtual reality shaped by social, political, cultural, economic, ethnic, and gender values	**Relativism- local and specific constructed realities**
Epistemology	Dualist/ objectivist; findings true	Modified dualist/ objectivist; critical tradition/ community; **findings probably true**	Transactional/ subjectivist; value-mediated findings	Transactional/ subjectivist; created findings
Methodology	Experimental/ manipulative; verification of hypotheses; chiefly quantitative	Modified experimental/ manipulative; critical multiplism; **may include qualitative methods**	Dialogic	Hermeneutical/ dialectical

[4] The attributes that are relevant to present research are highlighted in bold

Positivism has a value-free nature, and denotes the 'received view', closely linked to the naïve realism of 'scientific research'. Deductive methods and reductionist approaches are applied. Clear hypotheses are stated and tested via experiments or empirical data (Guba and Lincoln, 1994), utilising quantitative data and statistical analysis procedures.

Post-positivism essentially shares the same root as positivism, but abandons the dualism of positivism. Objectivity remains a 'regulatory ideal' (Guba and Lincoln, 1994). It is assumed that the absolute truth can never be found, so research evidence is always imperfect and fallible (Creswell, 2003).

Critical theory has the value-determined nature of inquiry (Guba and Lincoln, 1994). Creswell (2003) suggests that the *advocacy/participatory* category embraces critical theory. Advocacy/participatory claims that inquiry needs to intertwine with politics and a political agenda. Participatory actions is recursive or dialectical (Creswell, 2003).

Constructivism denotes that constructions are not more or less 'true' in an absolute sense (Guba and Lincoln, 1994). It is often combined with interpretivism, intending to develop themes from the data, and can be viewed as phenomenological research. Under this paradigm, subject meanings of the researcher's experience are developed, resulting in multiple meanings which are multiple and interpreted through a personal view (Creswell, 2003). Open-ended data and emerging themes are synthesised from qualitative data such as ethnography, narrative research and interviews.

Among the various research paradigm classification schemes, the current research finds Creswell's to be the most suitable paradigm, for his clear-cut denotation of paradigms (complementing Guba and Lincoln, 1994), and his advocacy of pragmatism that supports the position of the present research. His addition of *pragmatism* is noteworthy as an alternative to the polarised debate between positivism versus constructivism. Pragmatism claims knowledge out of actions, situations, and consequences rather than antecedent conditions as in post-positivism (Creswell, 2003). Pragmatist researchers are interested in using all possible approaches to understand the problem and adopt both qualitative and quantitative data, which

underpins mixed methods studies. Although it may be seen as a judgemental call for counting pragmatism as another philosophical stance because it stands away from the realism-relativism debate, it is the very attribute of pragmatism's problem-centred/ consequence-oriented approach that provides the argument for its status as a separate paradigm.

Social science research is not believed to carry any fixed epistemological implications. Researchers have to decide how and what kind of knowledge they want to gather about the world, but epistemological assumptions, values and methods are inevitably intertwined (James and Busher, 2009). Neither of the approaches to obtain knowledge is 'better' than the other, but some can be more or less appropriate according to the varying research aims and inquiries.

The present research has properties of post-positivism in terms of theory testing (previous findings works are used in the survey, collecting quantitative data), and in constructivism, in terms of the subjectivity in data interpretation and utilisation of open-ended question interviews and observations. Above all, pragmatism forms the fundamental basis of the current research as both qualitative and quantitative data are liberally obtained for the best understanding of the research problem.

3.3 Research approach

This section explains a range of research approaches, their characteristics, and the justification for selecting the *mixed methods* approach in this study.

After choosing a research paradigm, research approach and concrete methodology anf methods are decided. Creswell (2003) defines research approach as plans and procedures for research that can be classified into a) qualitative, b) quantitative, and c) mixed methods (multi-strategy). Qualitative research provides in-depth understanding of complex situations, whereas quantitative data can provide specificity and accuracy. He suggests that the division of qualitative and quantitative approaches should not be

considered as rigid, distinct categories. While a given study may tend to posit itself towards the more qualitative than the quantitative side of the continuum, or vice versa, it is possible to adopt mixed methods which can incorporate elements of both approaches. The mixed methods approach draws on the strength of both, and offers or more encompassing and comprehensive explanation. Hence it is often regarded suitable for practical or real-world applications (Prendeville, 2014). Additionally, the multi-strategy design helped this research address a wider range of research questions (Robson, 2011, p. 167). The mixed methods approach was decided for this study in light of the above strengths, but qualitative data is the main source being buttressed by quantitative data, in the hope that the latter can strengthen the findings of the former.

3.4 Unit of analysis

This section describes the unit of analysis of this study. It is linked with the fundamental question of what a 'case' refers to. Also, defining the appropriate unit of analysis is key to the accurate specification of research question(s) (Yin, 2003). It represents the core of the phenomenon that is studied in a bounded context, and is typically a system or action, rather than an individual, a group of individuals or an entity (Tellis, 1997; Yin, 2003).

Through an iterative process of defining the questions and revisiting the literature, the unit of analysis of this research has been defined as the first three gates and stages of the Stage-Gate model®, i.e. the *front-end of NPD process*. The detailed background of choosing the front-end of NPD is in Literature review Chapter (see Section 2.3).

3.5 Research design

This section draws the details and rationale of selected research strategies including multiple case studies, and questionnaire-based interview.

3.5.1 Multiple case studies

In order to address the research questions, multiple case studies were chosen as an appropriate methodology (See Table 3.3).

Table 3.3 Summary of case study

Definition (Yin, 2003)	An empirical inquiry in two aspects: a) investigates a contemporary phenomenon within its real-life context, especially when b) boundaries between phenomenon and context are not clearly evident.'
Characteristics (Robson, 2011)	• A strategy i.e. a stance or approach, rather than a method, such as observation or interview, • Concerned with research, taken in a broad sense and including, e.g. evaluation research, • Empirical in the sense of relying on the collection of evidence about what is going on, • About the particular; a study of that specific case (the issues of what kind of generalization is possible from the case, and of how this might be done, are important), • Focused on a phenomenon in context, typically in situations where the boundary between the phenomenon and its context is not clear, • Using multiple of evidence or data collection.
Benefits (Robson, 2011)	• Provides rich data and deep insight into social phenomena • Contribute uniquely to our knowledge of individuals, organizations or social phenomena • Retains the holistic and meaningful characteristics of real-life events

In particular, this research employed a comparative case method, as the evidence from multiple cases is often considered more compelling and robust (Herriot and Firestone, 1983 in Yin, 2003). Robson (2011) suggest that

> *"Multiple case studies help deal with analytic or theoretical generalization. The first case provides evidence, which supports a theoretical view about the*

phenomenon. This theory and its possible support or disconfirmation guides the choice of subsequent cases in multiple case studies. Findings, patterns of data from these case studies, which provides this kind of support, particularly if they simultaneously provide evidence, which does fit in with alternative theories, are the basis for generalization." (p. 140)

In this sense, each case study was selected with a purpose to gain contrasting results for predictable reasons, and confirms or defies the pre-established findings across various levels. Multiple case studies allow a replication logic, which may reinforce the external validity of the research data. In this study, the same selection criteria were adopted for companies and informants for each case to maintain the same logic. The nature of case studies requires multiple sources of evidence (Yin, 2003). This research adopted three methods of data collection: interview, observation, and document analysis. The chosen data collection methods for this research are introduced in the following section.

3.5.2 Two-phased questionnaires

This study adopted questionnaire-based interviews as the major method of data collection. The advantages of questionnaire are as follows:

a) Provide a simple and straightforward approach to the study of attitudes, values, beliefs and motives,
b) Can be adapted to collect generalizable information from almost any human population,
c) High amount of data standardization. (Robson, 2011)

To gain deeper insights of each case company, two sets of questionnaire for two phases were developed.

The first questionnaire is a 24-page in-depth investigation, underpinned by literature review and existing knowledge (see Appendix C). The questionnaire offers a systematic

structure covering 11 subjects of success factors with 596 closed questions (including sub-questions), and 14 open questions.

The major part of the questionnaire used a fixed set of closed questions and response alternatives with pre-specified and standardised wording. The Likert scale is adopted: one of the most common techniques for conducting an investigation of attitudes, i.e. a multiple-indicator or multiple-item measure of a set of attitudes relating to a particular area (Bryman, 2012, p.166). This study employed the 1-5 scale format, which indicates the level of agreements from *never (1), to neutral (3) and always (5).* Closed questions with scales are critical to collect quantitative data, as numerical at varied answer categories allow direct analysis (Robson, 2011, p. 266).

Open-ended questions at the end of each section enable the participants to expand on their answers. The qualitative data from open questions corroborate with the quantitative data from closed questions.

The second questionnaire is a concise version of the in-depth questionnaire. The main purpose of this 6-page questionnaire is to verify and probe the unclear details of the first questionnaire findings. It contains 59 closed questions, and 13 open questions (see Appendix D).

3.6 Data collection

This section describes how the actual data collection took place in case companies. Figure 3.3 (Section 3.1) graphically illustrates the flow of data collection for this study.

The data collection process comprised of two phases: in-depth, and verification studies. The findings from Phase 1 (two cases) were verified through Phase 2 (three cases) for reliability.

3.6.1 Case selection criteria

This section describes the rationale for the selection of sample cases. In order to fulfil the research objectives (see Section 1.3), a development of strategic selection criteria was necessary.

The anticipated output from the study was a comprehension of current FMCG practice, sustainable design implementation, and challenges. The specific focus was the front-end of NPD process. To ensure the data came from various perspectives of the case companies, the below criteria were established and applied:

a) Belonging to the FMCG sector,
b) Availability of sustainability track record,
c) Market leader,
d) Representative of a certain sustainability maturity model,
e) Accessible to various levels of employees,
f) Accessible to various functions within NPD process.

Criterion *a) Belonging to the FMCG sector*: the unit of analysis of this study should be situated within the FMCG context. The case FMCG companies are also required to manufacture and retail their products so that it is possible to view the sustainability practice across the production, supply chain and consumer relations.

Criterion b) *Availability of track record of sustainability commitment*, e.g. producing sustainability design products, publishing a sustainability report, running a department dedicated to sustainability, and acknowledged by global sustainability measuring institutions. Although there are legitimate debates over the arbitrariness of sustainability measurements (Ehrenfeld, 2013), they are nonetheless considered as one of the valid indicators of sustainability practice commitment, making them distinguishable from organisations that do not employ any sustainability practice.

Table 3.4 Comparison of sustainability maturity models in the existing literature

	Model	Author(s)	Year	Context	Levels
1	*The Five Stage Classification of Business Engagement*	Rischard, J-F. (in Davies, R. and Nelson, J., 2003)	2003	Corporate management	1 Charity 2 Defensive corporate social responsibility 3 Offensive corporate social responsibility 4 Development agent 5 Global problem-solver
2	*Five Stages of Corporate Responsibility Maturity*	Zadek, S.	2004	Corporate management	1 Defensive 2 Compliant 3 Managerial 4 Strategic 5 Civil
3	*Stages of Corporate Citizenship*	Mirvis, P. and Googins, B.K.	2006	Corporate management	1 Elementary 2 Engaged 3 Innovative 4 Integrated 5 Transforming
4	*Corporate Sustainability Phases*	Dunphy, D., Griffiths, A. and Benn, S.	2007	*Organisational Change management*	1 Rejection 2 Non-responsiveness 3 Compliance 4 Efficiency 5 Strategic proactivity 6 The sustaining corporation
5	*Five Stages of SMEs and Corporate Responsibility*	Grayson, D. and Dodd, T.	2007	SMEs management	1 Survivialists and denier 2 Compliers 3 Managers or Ethical 4: Integrators 5 Champions
6	*Four Stages of Sustainable Development Into Innovation*	Alakeson, V. and Sherwin. C.	2004	Sustainable innovation	1 The single issue approach 2 The *ad hoc* approach 3 Sustainability tools 4 The strategic integration
7	*The Environmental Stages*	Tien, S., Chung, Y, Tsai, C.	2005	Environmental design implementation	1 Reactive responses 2 Receptive responses 3 Constructive responses 4 Proactive responses
8	*Five Stages Of Sustainability Integration Into Business Activities*	Hallstedt, S., Ny, H., Robèrt, K. H., & Broman, G.	2010	Product development	1 Pre-Compliance 2 Compliance 3 Beyond Compliance 4 Integrated Strategy 5 Purpose and Passion
9	*Evolution Levels In Eco Design*	Pigosso, D.C.A., Rozenfeld, H. McAloone, T.C.	2013	Eco design implementation	1 little experience 2 Non-consolidated 3 regular basis 4 systematically incorporated 5 fully incorporated

Criterion c) *Market leading company with substantial consumer recognition.* This is to understand the sustainability practice of large-scale organizations, as the impact of which can be more substantial than those of SMEs.

Criterion d) *Representative of certain stage of sustainability maturity level (SML)*. Maier *et al.* (2012) undertook an extensive review of 24 maturity grids that assess organizational capabilities.

Although they include only one sustainability-related model in their audit, their notion of maturity helped to elicit an appropriate model for this study. The maturity levels include the process maturity, organizational maturity, process capability, project maturity, and maturity of organizational capabilities.

In accord with Maier *et al*.'s maturity categorisation, this study reviewed a total of nine existing sustainability maturity model literature. Table 3.4 allows a clear comparison of each model of different context and structure. Models no 1,2,3,4, and 5 fit into the *organizational maturity*, whereas model no. 6,7,8, and 9 stand on *process maturity*. As this study tries to comprehend the NPD process of FMCG organisations, the last four models were selected to be more pertinent. Among the last four, model no. 8 and 9 were finally chosen for this study, as model no. 6 and 7 contain four stages instead of five, which resulted in less detailed categorisation than model no. 8 and 9.

Combining the stages of model 8 and 9 complement each other, resulting in the below five stages of the SML for this research:

1. **Pre-Compliance & little experience**: *Ignoring* sustainability and opposing related regulations. *Very little experience* in eco design, do not yet completely apply eco design practices. Environmental issues and benefits are *not explored yet.* Understands eco design concepts, can define internal/ external drivers for its adoption, carry out *benchmark study*.

2. **Compliance & non-consolidated**: *Obeying laws* and regulations on labour, environment, health and safety. Familiar with some eco design practices and potential benefits. *Pilot projects* are implemented, focusing on the *incremental*

improvement of existing products, emphasis on specific phases of the lifecycle. *Non-consolidated* approaches. Endeavors to generate awareness and motivation for eco design. Adopts formal eco design programme. (A)LCA [(Abridged) Life Cycle Assessment] tools used.

3. **Beyond Compliance & regular basis**: Recognizing the opportunity to cut costs mainly through higher resource efficiency and waste reduction, leading to both financial and ecological gains. Sustainability is still separated from core business development. Recognizes the importance and benefits of eco design. *All the NPD* projects consider environmental issues on a *regular basis*. Eco design is *technically integrated.*

4. **Integrated Strategy & systematically incorporated:** Sustainability is *integrated in the company's vision* and informs key business strategies to be more successful than competitors through innovation, design and improved financial risk assessments. According to Willard, very few companies in the world have yet arrived at this stage. Eco design is *incorporated systematically* into the beginning of NPD. Eco design influences business, managerial, and technical areas. *New concepts* (e.g. product/service systems) can be developed.

5. **Purpose and Passion & fully incorporated:** This is not actually the next stage of development but rather a special type of company, being originally designed to '*help saving the world*'. Environmental issues are *fully incorporated into the company's corporate, business and product strategies,* reinforcing the decision-making processes. Aims at *system innovation*: developing new products and services that require changes in the business models and infrastructure.

In this study, the sustainability maturity level of each case company was decided based on the external information from websites and sustainability reports. Subsequently, minor adjustment was made in a retrospective manner as empirical data analysis provided a more informed view of companies with internal information.

Criterion e) *Accessible to various levels of employees.* This is for the triangulation of contents within company hierarchy. A single level of the company e.g. director, manager or employee level cannot represent the whole company.

Criterion f) *Accessible to various functions within the NPD process*. This is also for the triangulation of contents within company functions. A single function of the NPD process e.g. marketing, R&D or design function cannot represent the whole company.

However, criteria e) and f) did not fully apply to Phase 2: verification study, as the absolute number of informants from each company was small (1 or 2 interviews). Unlike Phase 1, where a multiple perspective was sought for the initial in-depth investigation, fewer cross-level / function interviews were used for the verification of the first findings. The omission of criteria e) and f) was a logistic decision to reduce the expenses relating to time and cost.

3.6.2 Case company introduction

a) Company A

Company A was selected as it meets all the above selection criteria; also it serves as one of two high sustainability level case companies in this research. The selection is attributed to its outstanding sustainability integrity, history and recognition.

Company A is a large FMCG manufacturer based in Brazil, engaged in the development, production, distribution and sales of cosmetics, fragrances, hygiene and health products under a range of brands. Since the beginning four decades ago, the company has been a pioneer in sustainability practice. Their unique business strategy to transform socio-environmental dilemmas into sustainable business opportunities while securing prosperity for everyone has proven successful. For example, the company continues to grow both its market share and social recognition in Latin America. Their carbon-offsetting programme started in 2007 is known to be one of the most efficient ones in Brazil. The company has won numerous awards for being the most valuable brand, best sustainable practice, or successful entrepreneur. In Deloitte's 2012 Zero Impact Growth Model assessment, Company A is amongst the highest ranking companies across all sectors for sustainable business practice. This group of six highest ranked companies was ranked in the second highest maturity

category, with no companies achieving the top level. Whilst this assessment is by no means definitive, it does provide an indication of the level of sustainable practices employed compared to others in the industry.

Two other elements of sustainable practice in Company A are an established set of a measurable and ambitious mid-to-long term target, and the implementation of sub-policies in a holistic strategic vision of minimising negative environmental and societal impacts.

b) Company B

Company B serves as the mid SML company in this research. Company B has a strong sustainability initiative from top management, but a clear set of sustainability business opportunities have not rooted yet.

Company B is large multi-brand FMCG corporate based in South Korea producing and distributing cosmetics, skin care, hair care, body care, and tea products. They have the largest market share in South Korea and also operate in China, France, USA and Southeast Asian countries. At the CEO's strong will, company B recently established a sustainability management committee in attempt to expand the sustainability management strategy across all subsidiaries. However their corporate vision to become Asia's no. 1 and global top seven beauty product company by 2020 does not include the long term sustainability vision.

Currently they are experiencing difficulties to recognise potential benefits of sustainability integration. Nevertheless their effort has been acknowledged externally, for example, they have appeared in Dow Jones Sustainability Index (DJSI) for three consecutive years as the section leader for personal products, as well as in Financial Times Stock Exchange Index (FTSE4Good) as the no.1 in the Asian region.

Company B's sustainability report (2012) shows that they have started their first sustainability innovation efforts and internal programme in certain areas. They also have developed initial policies and strategies. The cultural context being located in Far East Asia also provides an interesting comparison point.

c) Company C

Company C is one of the biggest multi-national FMCGs in the world. Company C boasts a vast range of products in beauty care, grooming, pet care, household care, and baby care sectors under more than 80 brands. According to their annual sustainability report (2013), they do have short-term sustainability goals and long-term sustainability plan and strategies at the corporate level. However these goals and plans were not apparent at the practice level. Recently (early 2014) Company C faced a global consumer petition about environmental issues of certain ingredient in their product, and they have succumbed to rectify the environment-threatening ingredient.

d) Company D

Company D is one of the major players in South Korea's FMCG sector. They produce beauty products, healthy care products, and household cleaning products. Company D produces sustainability report every year and with a short to mid term sustainability strategies for next two-three years but no long-term strategy exists. Company D is an interesting case that falls into the sustainability maturity stage 2, which is lowest rank in this research.

e) Company E

Company E is an up and coming FMCG based in the UK. They've been producing, manufacturing and distributing fruit beverages and food products to the UK and a number of European countries. Company E has been flourishing since it started less than 20 years ago with strong ethical initiatives. They still strive to do good by making healthy products and helping communities around the world. 10% of their profit goes to charities every year. Unlike the four other cases in this research, it is difficult to call Company E a multi-brand corporate as they run a narrow brand portfolio under a strong mother brand.

Table 3.5 Case company SMLs and decision rationale

		Company A	Company B	Company C	Company D	Company E
Before	Initial SML rating	5	4	3	2	5
	Available information	-Delloitt Zero Impact Growth Assessment (2012): highest rank -Annual Report (2012): Various sustainability activities (local material procurement, CSRs), measurable mid-to-long term target	-Dow Jones Sustainability Index: leader for personal care (2010-2012) -FTSE4Good: No.1 in Asia -Annual Report (2012): Starting of first sustainability innovation effort, (programmes, policies, strategies)	-Annual Report (2012): Awareness of sustainability issues, Active consumer communication of sustainability	- Annual Report (2012): No long-term sustainability plan, - Pilot sustainable brand launching experience (failed)	- Website: Clear sustainability communication, - CSR: 10 % charity donation, Aligned company vision with strong sustainability initiatives
After	Final SML rating	4.5 between *Integrated strategy & Systematically incorporated*, and *Purpose and passion & Fully incorporated*	3 *Beyond compliance & Regular basis*	2 *Compliance & Non-consolidated*	1.5 Between *Pre-compliance and little experience,* and *Compliance & Non-consolidated*	4 *Integrated strategy* & *Systematically incorporated*
	Rationale	- Eco design is not fully systematically incorporated but in the process. - Aims at system innovation, holistic vision of negative impact minimisation -Environmental issues are fully incorporated into company's corporate strategy, business and product strategies.	-Recognising the opportunities, and importance, but not fully gaining benefits from eco design. -Sustainability is still separated from core business development	- Ignorance of sustainability issues at practice level - Explicit separation between corporate vision and sustainability vision - Least eco design effort	-Some understanding of eco design but least experiences - No formal eco design process, some pilot projects - Environmental issues and benefits not explored	- Eco design is not fully systematically incorporated but in the process. -Eco design influence business, managerial, and technical areas - No development of new products / services that require changes in business model and infrastructure

Nevertheless, Company E is an example of brands whose values have been established and communicated over relatively short periods of time, and consumers perceive them

to have strong sustainability credentials. Hence this case is another best-case company in this research.

Table 3.5 summarises the SML (Sustainability Maturity Level) rankings of case companies, available information that assisted the rankings, and the rationale for final rankings. The decisions of the SMLs were adjusted during data collection and analysis due to either the discrepancy between the public image and their internal manifestation in practice (i.e. Company C, D), or the details in decision-makings and implementation procedures resulting from a closer inspection (i.e. Company A, B and E). SML scale (1 to 5) is based on the five stages of SML in the previous section (Section 3.6.1).

3.6.3 Case company approach

Table 3.6 lists the endeavours to approach case companies. The efforts were made throughout the research period right from the preliminary stages (October, 2011) until the beginning of the final writing stage (March, 2014).

Over the 17 months of data collection period, a total of 11 companies were contacted and five resulted in successful case studies.

NPD activities are so commercially sensitive for many companies that the difficulty in collecting data about NPD is not surprising (Felekoglu and Moultrie, 2014). Out of 11 initial company approaches, eight companies agreed for collaboration, and finally five companies completed the data collection: overall success rate of 45.45%.

With an exception of one company, all of the successful approaches were made through already established contacts. Amongst the failed approaches, one company turned down the request from the first contact, whilst two others did not respond at all. Three companies were notable: the collaboration was agreed at the higher management level (one case the chief sustainability officer, two others the founding directors) but actual arranging of the interviews failed. Notably, the founding director

of one of the UK's well-known sustainable personal care brand companies agreed to data collection after several persistent attempts, however the appointed designer was not supportive enough achieve collaboration.

Table 3.6 Company contact list

	Location	Contact point	Contact date	Success Y / N	Research application
1	Brazil	Conference contact	10.2011- 05.2013	Y	In-depth
2	UK (global)	University / conference contact	11.2011-10.2013	N	n/a
3	UK	Cold emails	05.2012	N	n/a
4	South Korea	Work contact	05.2013-07.2013	Y	In-depth
5	South Korea	Personal contact	05.2013-03.2014	Y	Verification
6	UK	Cold emails/ company visit/ retail shop visit	09.2013-02.2014	N	n/a
7	UK (global)	Supervisor contact	10.2013-02.2014	N	n/a
8	UK	Supervisor contact	11.2013-12.2013	Y	Verification
9	UK	Cold emails	11.2013-02.2014	N	n/a
10	UK (global)	University / personal contact	12.2013-02.2014	Y	Verification
11	USA	Personal contact	01.2014-02.2014	N	n/a

For Phase 1, two FMCG companies were selected in accordance with the criteria a) to f). In order to maintain confidentiality, the cases are referred as Company A and B. The research collaboration request was made through formal emails (see Appendix E). Contact to case A was made during the author's participation in Sustainable Innovation Conference in 2011. Contact to case company B was made through the author's own connection. The time from the initial contact to the actual site visit to collect data took an average of two months. As at least seven interviewees at various level and functions from each company was required, arranging every interviewee's schedule was challenging. Moreover, both companies were abroad, which required the author

to travel from the UK and all the interviews has to be arranged within a given timeframe: a week.

In respect with Phase 2 data collection, three more FMCG companies were chosen according to the selection criteria a) to d). Five interviews at case C, D and E were made though the supervisor and author's personal contact, respectively.

In conclusion, the thread of endeavours for data collection provided a valuable opportunity to experience the difficulty of conducting an industry practice-based research from scratch, and the importance of making the research design feasible.

3.6.4 Questionnaire-based interview

Based on the questionnaire in Section 3.5.2, interviews were made on a face-to-face basis. Questionnaire-based interview allows the researcher ask questions and complete the questionnaire in the presence of the respondent. Advantages of this method are:

a) Open-ended questions for qualitative data are possible,
b) Interviewer can clarify questions,
c) Presence of interviewer encourages participation and involvement. (Robson, 2011).

A total of 19 interviews were undertaken. The details of each interviewee including their position level, function, and the length and location of interview are illustrated in Table 3.7.

In Phase 1: in-depth study cases, all 14 questionnaire-based interviews were conducted at company headquarters. Importantly, each company was asked to arrange one-on-one interviews with seven employees from various departments and positions that are directly or indirectly involved with the NPD process. Interviewees were deliberately chosen from different levels of the company hierarchy for the triangulation of contents.

Table 3.7 List of interviewees and interview details

	Interviewee function	Level	Location	Style	Length
Case A	1. Packaging development coordinator	Employee	Company headquarters, Brazil	Face-to-face	2hr11'04"/1,637 wds
	2. Marketing manager	Manager	,,	,,	1hr56'15''/4201 wds
	3. Corporate brand manager	Manager	,,	,,	1hr54'10"/4404 wds
	4. Strategic planning director	Director	,,	,,	1hr56'19"/4120 wds
	5. Sustainability R&D manager	Manager	,,	,,	1hr12'46"/2260 wds
	6. Eco design manager	Manager	,,	,,	1hr46'46"/3493 wds
	7. R&D researcher	Employee	,,	,,	1hr37'40"/ 1129 wds
Case B	1. Sustainable growth director	Director	Headquarters, South Korea	Face-to-face	2hr44'28"/ 5817 wds
	2. Corporate sustainability manager	Manager	,,	,,	1hr45'11"/4734 wds
	3. Brand manager	Manager	,,	,,	54'05"/ 1917 wds
	4. Design manager	Manager	,,	,,	2hr00'21"/3631 wds
	5. R&D manager	Manager	,,	,,	2hr14'26"/3021 wds
	6. R&D researcher	Employee	,,	,,	1hr09'08"/2665 wds
	7. Project communication coordinator	Employee	,,	,,	1hr18'52"/1866 wds
Case C	1. Senior design manager	Manager	Private location, UK	Telephone	51'21"/1414 wds
	2. R&D director (Former)	Director	Private location, UK	Face-to-face	1hr19'21"/4332 wds
Case D	1. Senior design manager	Manager	Private location, South Korea	Telephone	1hr08'14"/2453 wds
	2. Senior packaging designer	Employee	Private location, South Korea	Face-to-face	46'28"/2872 wds
Case E	1. Packaging specialist	Employee	Company headquarters, UK	Face-to-face	28'28"/2299 wds

Different levels can view the same situation from different perspectives, and consequently, often yield contrasting answers even to purely factual questions. Also

this allows observing the hierarchical differences, which sometimes can be a highly dominant attribute in some cultural contexts.

The verbal qualitative data was captured using digital audio recording, and transcribed word by word for accuracy. In company A, a total of 12 hours of audio files were recorded and later transcribed by the author into 21,119 words. For company B, 18 hours were captured and transcribed into 23,401 words. Although Portuguese is their mother tongue, the interviews with company A were conducted in English while Korean was used in Company B. All the transcription was done in its original language. After the first phase of analysis of data, only selected parts of the transcription for Company B were translated into English. (see Appendix F for sample transcription). Numerical quantitative data was also captured and later consolidated onto an Excel spreadsheet to gather descriptive statistics.

In Phase 2: verification study cases, a total of five interviews were undertaken in three companies based on the 6-page summary questionnaire. Although it would have been ideal to have various interviewees from different functions and positions so that bias is minimised, only one or two interviewees were available from the respective companies.

Two out of five interviews took place via telephone for reasons of time and cost. However, the questionnaire was sent to the interviewees a week before in order to minimise potential misunderstanding that may take be caused by the lack of physical interaction. Although quantitative data was also gathered as well as qualitative data, only qualitative data were later used in the analysis, as the number of the informants was not significant enough for meaningful statistical analysis. Again, all the interviews were audio recorded under permission and later transcribed by the author. From company C, a total of two hours was recorded resulting in 5746 words for two interviews. Company D yielded two hours of audio file and 5325 words for two interviews. Company E had the least number of interviewee: 1. However, two company presentations and an hour's company tour enabled the gathering of an

equivalent amount of data. The interview in company E offered 28 minutes and 2299 words.

3.6.5 Document analysis

As well as the interview transcription, document analysis provided another important source of qualitative data. Company websites, sustainability reports and third party market reports were used. Table 3.8 shows the details of document sources. Only publicly available open sources were used for this study.

Table 3.8 List of the analysed documents

	Website	Sustainability report	Market research report	Etc.
Case A	Yes	Yes (2012)	Yes	Conference presentation
Case B	Yes	Yes (2012)	Yes	E-Newspaper articles
Case C	Yes	Yes (2012, 2013)	Yes	External report and book
Case D	Yes	Yes (2012)	n/a	E-Newspaper articles
Case E	Yes	n/a	n/a	Management research report

Publicly available company information played an important role in terms of triangulating the data. Many cases demonstrated a disparity between their public sustainability image and the internal perception or actual implication on sustainability.

3.6.6 *In-situ* observation: site visits

All the interviews of the first three cases took place at companies' headquarters, hence ample *in-situ* observation opportunities were available. Observations are beneficial as a substantial amount of qualitative data from observation provides an opportunity for a deeper understanding of the company context (Robson, 2011). *In-situ* observation provides qualitative data that is difficult to gain from verbal communication, and those

that are different from formal interviews. In addition, an insider view of the organizational culture can be captured, thus being useful for further triangulation of data. Table 3.9 lists the time and activities that took place in each case company. Moreover, observation can offset the disadvantage of face-to-face interviews, which require relatively higher cost and time than postal, internet or telephone interviews (Robson, 2011).

Table 3.9 List of *in-situ* observation details

	Location	Time / date	Activities
Case A	Company headquarters, Brazil	12.05.2013-17.05.2013	Interview stand-by Visit office floors Visit marketing department (separate location) Lunches / Tea times Factory Tour
Case B	Company headquarters, South Korea	26.06.2013-03.07.2013	Interview stand-by Visit office floors Visit design labs Visit company library Lunch
Case C	n/a	n/a	n/a
Case D	n/a	n/a	n/a
Case E	Company headquarters, UK	12.12.2013	Interview stand-by Company presentation Company tour

In Phase 1, interviews took place at the company headquarters in Sao Paulo, Brazil and Seoul, South Korea for five days and seven days, respectively. In order to accommodate their busy daily schedules, the author was on stand-by mode from 9 am to 5 pm everyday. This offered valuable opportunities for *in-situ* observations and field note taking between interviews.

In Phase 2, only one company was available for a site visit due to limited cost and time. The site visit to company E was a one day visit from 2pm to 7 pm.

3.6.7 Triangulation

Triangulation increases comprehensiveness and completeness of research (Miles and Huberman, 1994). The other advantage is that triangulation confirms trends and identifies inconsistencies, as well as improving reliability and validity (Weyers *et al.,* 2011). Yin (2003) referred to Patton (1987) who discussed four types of triangulation in evaluation as below:

1) **Data triangulation**
   Comparison of the evidence produced by different techniques
2) **Investigator triangulation**
   Triangulation among different evaluators
3) **Theory triangulation**
   Multiple interpretation of the same data set using multiple theories
4) **Methodological triangulation**
   Use of multiple techniques of the same or two or more methods to measure the same problem

Recently, Weyers *et al.* (2011) added two more to the above categorisation.

5) **Triangulation of paradigms**
   Combination of qualitative and quantitative styles
6) Interdisciplinary triangulation
   Variation of investigator triangulation but evaluators from different disciplines

This study utilised multiple triangulation techniques: 1) data triangulation, 2) investigator triangulation, 4) methodological triangulation, 5) triangulation of paradigms, and triangulation of contents.

1) Data triangulation is done through collecting multiple data from survey, interview, document analysis and *in-situ* observation. The independent sources of information were compared to reveal similarities and incongruencies.

2) Investigator triangulation was made through the arbitration processes with a research colleague and the supervisor. Different evaluators within the same sustainable design research disciplines crosschecked the data findings and supporting quotes.

4) Methodological triangulation was undertaken by using 19 sets of questionnaires, observation, and interviews. This enriches the understanding of the deeper and varied dimensions of a given phenomenon (Robson, 2011).

5) Triangulation of paradigms refers to the combination of qualitative and quantitative data to utilize the complementary strengths of both. This is directly linked to the mixed methods for analysis. Firestone (1987) supports mixed methods as quantitative studies 'persuade' the reader by de-emphasizing individual judgement. This leads to more precise and generalizable results. Meanwhile, qualitative research persuades through rich depiction and strategic comparison that enables overcoming the "abstraction inherent in quantitative studies". Linking qualitative and quantitative data also initiates new lines of thinking diverting attention to surprises or paradoxes, "turning ideas around", and by providing fresh insight (Miles and Huberman, 1994).

In addition, this research executed the *triangulation of contents* by asking a set of three fixed questions about 'importance, frequency and effectiveness' of each subject matter (Figure 3.4).

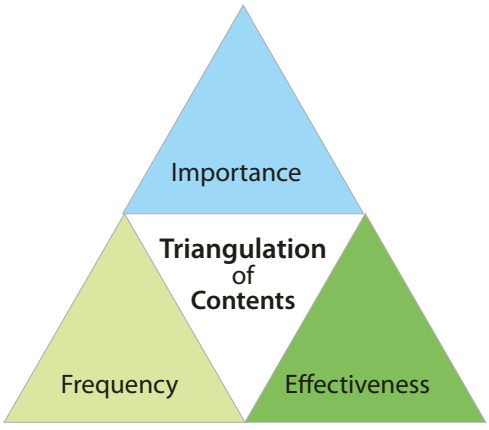


Figure 3.4 Triangulation of contents through question types

The triangulation of contents contributed to identify certain phenomenon within each case company, which would have not been possible otherwise. A set of three questions about different aspects of the same subject matter articulates the difference between obligation (perceived importance) of factors, and realization (frequency and effectiveness of the execution). This triangulation assisted to answer Research Question 4.

Table 3.10 The triangulation of contents in Phase 1

		Quantitative Data							Qualitative Data	
		Survey questions							Open-ended questions	Interview transcription
Common factors	**Factors**	Importance	Frequency	Effectiveness	Particpants	Typical usage	Presence of subject factor	Entailing value	Definition of success	Dialogue during the survey
	Consumer Involvement	v	v	v	v	x	x	v	v	v
	Senior Management Support	v	v	v	v	x	x	v	v	v
	Internal communication	v	v	v	v	x	x	v	v	v
	Cross-functional team	v	v	v	v	x	x	v	v	v
Sustainable design factors	Common use of language	v	v	v	x	v	x	v	v	v
	Sustainability champion	v	v	v	x	x	v	v	v	v
	Sustainability tools	v	v	v	x	x	x	v	v	v
	Sustainability in brand vision	v	v	v	x	x	v	v	v	v
	Company culture for sustainability	v	v	v	x	x	x	v	v	v
	Sustainable design practice	v	v	v	x	v	x	x	v	v
	Personal aspects	v	v	x	x	x	x	x	v	v

Table 3.10 and 3.11 respectively demonstrate the triangulation of contents for each factor in data collection Phase 1 and 2.

Table 3.10 shows the details how survey questions, open-ended questions, and interview transcription have been used for each factor's triangulation in data collection Phase 1. Basically, all factors have been touched upon in three ways both in qualitative and quantitative approaches (indicated with V and X in Table 3.10). In terms of qualitative approach, i.e. open-ended questions and transcriptions, no omission was made, whilst a number of subsection questions in survey (quantitative data) was omitted. Given that factors have different attributes, it is natural that some questions

(e.g. participants, typical usages, presence of the subject factors, and entailing value) were not applicable for some of them.

Table 3.11 The triangulation of contents in Phase 2.

	Quantitative Data						Qualitative Data	
	Survey questions						Open-ended questions	Interview transcription
Factors	Importance	Frequency	Effectiveness	Easiness	Presence of subject factor	Focus/ satisfaction	Various	Dialogue during the survey
Idea generation	x	x	x	x	x	x	v	v
Consumer focus	v	v	v	x	x	x	v	v
Senior management support	v	v	v	x	v	x	v	v
Internal communication	v	v	v	v	x	x	v	v
Cross-functional team	v	v	v	x	v	x	v	v
Sustainability wording	v	v	x	x	v	x	v	v
Sustainability champion	v	v	v	x	v	x	v	v
Sustainability tools	v	v	v	x	v	x	v	v
Sustainability vision	v	x	x	x	v	x	v	v
Company culture for sustainability	v	x	x	x	v	x	x	v
Focus on growth	v	x	x	x	x	x	v	v
Sustainability design implementation		x	x	x	x	v	v	v
Individual attitude	v	x	x	x	x	v	v	v

Another contents triangulation was made in data collection Phase 2. Table 3.11 shows the details how survey questions, open-ended questions, and interview transcription have been used for each factor s triangulation in Phase 2. The Phase 2 collection process was simplified to serve the main purpose of verification of the Phase 1 findings. Thus some factors cover only qualitative approach, as a limited number of samples was not adequate to form valid statistics. Nevertheless survey questions were asked where possible in order to compare with the Phase 1 result. (indicated with V and X in Table 3.11). In terms of qualitative approach, i.e. open-ended questions and transcriptions, only one omission was made in company culture for sustainability factor. Triangulation of contents served the purpose of mixed methods in which qualitative and quantitative data complement each other, and strengthen the validity of findings.

Also, interviewees from different levels and functions within a company contribute to the reliability of the data and analysis through another level of triangulation of contents.

3.7 Data analysis

The objective of data analysis is to provide uncomplicated summaries of the resulting data by performing appropriate analysis of the sample data set. This section describes two analysis techniques used on qualitative data and quantitative data.

3.7.1 Qualitative analysis: Thematic coding

Firstly, the major part of qualitative data was gathered by transcribing the audio recordings. The author transcribed all the recordings verbatim in its original language. Despite being very time-consuming, this process provided the author an excellent opportunity to gain familiarity and deeper insights of the data. The insights during this operation were added in brackets as the transcription proceeded. A sample transcription file is available in Appendix F. In the sample file, the first coding extractions are indicated in different colours.

Secondly, based on the transcription of interviews and field notes, thematic coding analysis was carried out. Thematic coding is a straightforward generic approach used in a wide variety of settings. This helps summarize key themes emerging from multitudinous qualitative data (Robson, 2011). In this approach, codes that play major roles are grouped together as factors and elements afterwards. Then codes and themes are determined inductively from reviewing the data and research questions, previous research or theoretical considerations. In the next step, themes serve as a basis for further data analysis and interpretation (Robson, 2011).

In this study, the first findings of the thematic coding analysis were used as a basis for Phase 2 of data collection. The analysis process was relatively direct as the interview was guided by the questionnaire that had been already developed based on 11 factors extracted from the literature review. These 11 factors formed the theoretical foundation for both qualitative and quantitative data analysis. The main contribution of thematic coding analysis in this study was the identification of 25 elements. Phase 1

findings were later refined into 11 factors and 32 elements following the analysis of Phase 2 verification data (see Appendix G for sample coding process of case A data).

For qualitative analysis a range of software was initially considered, but the dataset (19 sets of interview transcription) was relatively small, so it was decided that this was not necessary. Robson (2011) repeatedly claims the needlessness of complex statistic methods or specialist software only for the sake of using them. He argues that simple descriptive statistics and everyday numbers can be successfully used for most of the purposes of real world research. Standard word-processing software, Pages (Mac equivalent of MS Words) proved sufficient for the necessary functions. Nevertheless, the appropriate use of a type of CAQDAS may be beneficial when managing substantial amounts of qualitative data.

3.7.2 Arbitration process

Arbitration was conducted for a total of four sets of qualitative data analysis by a doctoral research colleague, two supervisors, and one of the key informants. Different evaluators within the same sustainable design research disciplines crosschecked the appropriateness of research results and selected evidence. The key informant from case A read though the findings and the supporting quotes, and confirmed no misinterpretation of interviews. The benefits of the arbitration are twofold: it enhances the validity of data (Yin, 2003), and triangulates the data through evaluating the same data with different investigators (Patton, 1987; Weyers *et al*., 2011).

3.7.3 Quantitative analysis: Descriptive statistics

Descriptive statistics establishes a series of measures that represent some important aspect of the data by a single number (Robson, 2011). Descriptive statistics summarise the sample to reveal measures of central tendency, variability or the level of distribution.

This study adopted the measures of central tendency i.e. the mean, and the measures of variability i.e. coefficient of variance. The mean is the most common and general measure of the mid-point of a set of values (Field, 2009). However the mean is prone to distortion by the presence of extreme values and requires a measure of distortion. Hence, in this study, the coefficient of variance is employed as a normalized measure of dispersion of a probability distribution or frequency distribution.

The coefficient of variation (CV) is defined as the ratio of the standard deviation (σ) to the mean (μ):

$$Cv = \frac{\sigma}{\mu}$$

The coefficient of variation (CV) shows the extent of variability in relation to the mean of the population. In order to make sense of the spread of the data, i.e. standard deviation, it is important to take into account the mean by calculating the CV. For comparison between data sets with different units or widely different means, the coefficient of variation should be used instead of the standard deviation.

This study focused on identifying the most common or frequently occurring values in the data. The CV was used to measure how well the mean represented the data. Large coefficient of variation typically shows that the mean is less representative of the samples. In this study, a CV value of ≤20% was considered as the criterion. In other words, values falling under this line implied that no one practice was being universally adopted. The findings are presented in descriptive statistics with mean and coefficient of variation and later illustrated in column charts. (Appendix H)

As this study carries out relatively simple statistics, the standard spreadsheet software Excel provided sufficient calculation support for the research purpose.

3.7.4 Integrating qualitative and quantitative data

With reference to mixed methods aforementioned in Section 3.3, this study collected data in both paradigms in tandem. In the process of data analysis, Robson (2011, p. 493) suggests the following steps citing Onwuegbuzie and Teddlie (2003) (not necessarily in linear sequence):

1) **Data reduction**
2) Data transformation
3) Data correlation
4) Data consolidation
5) **Data comparison**
6) Data integration

The integration of data in this study took place in the form of 1) data reduction, and 5) data comparison. Regarding data reduction, the integration of qualitative and quantitative data allowed summarising the complex mass of data into a number of understandable themes. As of data comparison, both data were compared with each other to gain the most accurate illustration of the phenomenon. Also, both the qualitative data and quantitative data were utilised to answer different research questions.

3.8 Ethical considerations

Taking account of ethical aspects at the very early stage of the research project is vital. Ethical decisions of this research were made according to the following principles: a) a commitment to the participants' right, and b) a commitment to knowledge within the case organizations. In line with other views of good practice by ethical research boards

and committees such as the UK's data Protection Act (1988), anonymity was given to all participating individuals and organizations. Without anonymity, not only would this risk the loss of privacy, it could potentially result in negative consequences if participants were personally identified in reports or publications (Robson, 2011, p. 208). Also, participants may be less willing to provide information about themselves and their company if they were concerned of being identified.

This research followed the Conduct of research of Cranfield University. The scope of the approval includes *informed consent, no use of deception*, *freedom of participation, right of withdrawal, use of incentives, confidentiality, anonymity, data storage, protection from harm, debriefing, conflict of interest,* and *Professional conduct.* The University's Research Ethics Committee approved this research as a 'Low risk research' (see Appendix I).

The outline of the research and interview was sent to the interviewees prior to an interview. All the audio recordings were administered under the informants' verbal permission at the beginning of the interview, which is available in the same audio files. The confidentiality of the interviewees was informed to every interviewee in written format on the front page of the questionnaire (see the front page of Appendix C and D).

3.9 Addressing the limitations of research design

This section lists the limitations of research methods that this research has adopted. Reflecting the real world, this research is subject to certain weaknesses. In response, how those limitations are addressed follows.

3.9.1 Limitation of case study

Whereas seven informants are used in Phase 1 of in-depth cases, the Phase 2 of verification cases employ only one or two informants. An *effect of sample size* is

inevitable in Phase 2. Especially it was more obvious in the statistics of the Phase 2 data. Triangulation of data is performed to rectify this weakness, and interestingly, comparison of data and public sustainability reports of mid-to-low SML companies results in an even bigger disparity between the insider view and the public image.

The *issue of generalisability* is often seen as a drawback of case studies. This is often the case because a case study is usually confined to a single or a few instance(s). This issue has been aptly addressed by researchers such as Flyvbjerg (2006). He claims that it is pertinent to the case, and how it was selected. Thus this research has constructed and deployed *strategic case selection criteria* to overcome the issue of generalisation.

Although the five cases cannot represent the whole FMCG sectors, the selection criteria helped alleviating the randomness of cases. The selected cases provided appropriate real-world situations, which resulted in a rich and holistic account of FMCGs in various backgrounds. Also *multiple triangulations of data, investigator and methodology* were conducted to improve *reliability* and *validity* (see Section 3.6.6). By using multiple data sources, running arbitration through researchers and representative informants, and adopting mixed methods, the research methodology was able to obtain more *generalisability*.

Moreover, verifying the first case study findings through the second phase case study helped gain more *validity* and tackle the second limitation of case studies: *subjective bias*. In fact, the two-phased case study resulted in debunking the author's preconceived notions many times. The details are explained in various sections in Chapter 4 and 5 in parallel with the details of each finding. As mentioned above, investigator triangulation was utilized to curtail subjective bias.

3.9.2 Limitation of mixed methods

The main disadvantage of mixed methods is the time and resources required to reach a professional standard (Robson, 2011). For a novice researcher, collecting qualitative and quantitative data often required extensive time, energy and expenses. In this

research, the main data collection was face-to-face basis, which involved more time and expense than telephone or internet-based data collection. However, this research has taken account of this disadvantage by collecting multiple types of data simultaneously. Supplementary data was later sought by email communication to minimise extra time and expenses.

3.9.3 Limitation of triangulation

The triangulations employed to cope with the limitation of case studies mentioned above, can incur disadvantages such as high cost, and effort (Weyers *et al*., 2011). Again this addressed by conducting simultaneous collection of multiple types of data. Another limitation of triangulation is that it generates a mass of data. However, data reduction was possible through integrating qualitative and quantitative data.

3.10 Summary of research methodology

This chapter explains the research methodology adopted for this study in pursuance of the research aim and objectives in Chapter 1. Research Questions 1-4 are introduced to fulfill the objectives.

Three major stages of research activities are adopted: preliminary study, research design, and data collection and analysis.

The preliminary study lays down the theoretical grounds of the study. This stage includes cross-disciplinary literature review, and exploratory data gathering.

For research design of data collection, the mixed methods approach is employed, which utilises multiple case studies of five FMCG companies. Qualitative and quantitative data are collected through questionnaire-based interviews in two phases: in-depth and verification. For analysis, multiple sources of data e.g. interview

transcriptions, field notes, public documents, and questionnaire answers are used. Two-phased thematic coding process and arbitration of qualitative data are deployed, and answer Research Question 1,2 and 3. Descriptive statistics, the results of quantitative data analysis answer Research Question 4.

The multiple sources of data allow data triangulation, investigator triangulation, methodological triangulation, triangulation of paradigm, and triangulation of contents.

The limitations of research design regarding case study, mixed methods, and triangulation are addressed through various techniques such as strategic selection of cases, arbitration process, and simultaneous collection of qualitative and quantitative data.

The next chapter illustrates the research results.

4. Result 1: In-depth case studies

This chapter presents the outcomes of Phase 1: in-depth case studies. Two FMCG case studies were conducted to examine the factors from Chapter 2. Data is introduced in a thematic format through mixed-methods analysis. The implication for further verification is discussed.

4.1 Introduction and Purpose

The purpose of Phase 1 is twofold: a) to address the factors that have been identified in the literature, and b) to add new factors and elements. 'Elements' are used to describe the identified constituents extracted from the current research context: sustainable design, front-end of NPD, and FMCG.

Two cases were chosen in accordance with the selection criteria in the Methodology Chapter (see Section 3.6.1) to represent mid and high sustainability maturity level (SML) FMCG companies. Also both companies are the biggest market sharers in the personal care product market in the respective countries. The 14 in-depth interviews at these cases allow a first-hand understanding of the sustainable design implementation in the NPD process. See Section 3.6.2 for company A and B introductions and their SML levels.

4.2 Sampling within each case company

In each company, seven interviews were undertaken, resulting a total of 14 interviews. As described in Table 3.5 (Section 3.6.3), individual interviewees were selected to represent different functions at different hierarchical positions to gain various perspectives about the company's sustainable design implementation. All interviewees are involved in the NPD process with general knowledge of the current practice. Each interview lasted approximately 1 to 2 hours. Some of the interviewees were contacted afterwards for further clarification of some answers. Both companies allowed the researcher to visit the headquarters for interviews for five to seven working days. This allowed ample *in-situ* observation opportunities for non-verbal insights of daily routines and the corporate culture.

4.3 Assessment of In-Depth Data

This section describes the initial findings from the in-depth cases. Emergent factors from the analysed responses are discussed using qualitative and quantitative data where appropriate. 11 factors and a series of elements are suggested in each sub-section.

This section addresses and adds further details of the findings that previous studies have highlighted in the real world context: the front-end of NPD process in the FMCG companies. The confirmed findings include *senior management support, sustainability vision, internal communication, cross-functional team, supportive corporate culture* and *individual attitude.* In addition, the FMCG specific factors such as *balanced focus of growth* and *maturity of external contexts* are newly added. This section also investigates the perceived importance, actual frequency and effectiveness of factors, as well as the current implications of them.

4.3.1 Factor 1: Senior management support

The importance of senior management support is argued to be critical both for successful sustainable design implementation and NPD by numerous academics (see Section 2.7.1). In this study, both case A and B confirm that senior management support plays the foremost role in implementing sustainability in their business practices. This includes verbal / non-verbal actions and mind-set through a) firm sustainability leadership, b) understanding of sustainability principles, and c) rewarding individuals for sustainability achievement. The following sections use quotes that are extracted from interviews to illustrate the elements of senior management support in the FMCG context.

a) Firm sustainability leadership

This study defines firm sustainability leadership as the determined sustainability direction demonstrated by senior management's decision-making. Once the sustainability goal is firmly determined, the influence of other issues such as financial performance can be regulated.

> ***Company A****: "To have sustainability as basic / fundamental innovation, sometimes they need to make tough decisions... there is a point in which TBL (Triple Bottom Line) has to be presented at the decision making. If senior management doesn't care about TBL, they will naturally look only at the financial numbers. If they don't give a correct balance, the realistic reaction will be, 'this is good. But how do we make money on this?'" (Strategic planning director)*

> ***Company A****: "We are a company that considers sustainability and it's the most important part of the company." (R&D researcher)*

In Company A, where the SML is high, the sustainability leadership at CEO level appeared to be firm. The top-level management was found to be determined about company's internal/external everyday sustainability practices. As well as the current

CEO, the founders of Company A have a high reputation both inside and outside the company. Many employees showed their admiration for their strong leadership and personal lives.

> ***Company A**: "The founder is a very strong reference. His personal life and professional life are the cause [sic]. Our founders are **very strong leaders**." (Corporate brand manager)*

> ***Company A**: "Having the sponsorship from the executive committee is very important. Having the VP and others very active [sic]. We are working to make the sponsorship even stronger." (Strategic planning director)*

Interviewees from Company B also indicated that significant sustainability leadership exists from the top level.

> ***Company B**: "This is impossible without the willpower at the top management level." (Innovation manager)*

> ***Company B**: "Sustainability is very difficult to be bottom-up. Without the CEO's strong willpower, the reality kicks in so easily. So it (senior management support) is important." (Strategic planning director)*

> ***Company B**: "The **CEO is very enthusiastic** about the country's environment. So he tries to do a lot." (Brand manager)*

However, curiously, in Company B, one of the employees at the bottom level had a contrasting view.

> ***Company B**: "I have barely heard the top management talking about sustainability." (Project communication coordinator)*

This could indicate that sustainability is not sufficiently supported and penetrated throughout the company to the lowest level in Company B. Also, the design manager shared concerns regarding sustainable design practice.

***Company B**: "We need the **unshakable senior leadership**. No matter how hard we want to push sustainable design at the bottom, if they are not enthusiastic to overcome the challenges… for example, recycled materials are much more expensive and tricky to handle. It's prone to blisters during the forming process. At the higher error rate like this, people often say, 'Well, let's use virgin materials.'" (Design manager)*

b) Understanding of sustainability principles

Sustainability is a relatively new, highly complex and indefinitely evolving concept. Although not at an expert level, data indicates that a level of understanding in sustainability principles is required from senior managers. Decisions made without understanding can be antagonising rather than supporting the project level employees to convey the sustainability decisions to the NPD processes.

***Company A**: "It's clear that the very top level gives you a very high level recommendation. But the intermediate managers suffer, as they have to struggle with the contradictory target... The solutions for applying sustainability depend on the middle manager. The dilemma they suffer is actually from the top manager. Because it's complex and conflicting but the top doesn't care!" (Eco design manager)*

***Company A**: "Sustainable design is very related to the leadership and how we grow… the [sustainability] **knowledge** for management is so important." (Corporate brand manager)*

***Company B**: "The top management would rather draw the big picture so they don't know about this (NPD process) well… We know better. So we update them with such information from insight, trends and information through a regular sustainability committee every quarter." (Corporate sustainability manager)*

c) Rewarding individuals for sustainability achievement

The following quotes articulate the previous literature claims about financial incentives towards individual sustainability achievement (Boks, 2006; Hallstedt *et al*., 2010). The data indicates that both companies have some form of reward system but interviewees believe that they could be improved.

> ***Company A**: "We do have something, but we could have more… This is one of the very important aspects of our strategic planning now*." *(Strategic planning director)*
>
> ***Company B**: "I wish there were financial benefits." (R&D researcher)*

Within Company A the requirement for financial incentive is strictly based on TBL (Triple-Bottom-Line) achievement.

> ***Company** A: "it is a combination of economical [sic] achievement, carbon emission, and the loyalty levels. Although we achieved the economical growth, we didn't achieve the goal in relationship (last year). It's **about TBL** and it was not sustainable in social (aspect). So we didn't get the bonus. It's not that we had a terrible result but not enough in the three dimensions." (Corporate brand manager)*

However in company A, the lowest level interviewee was not aware of incentives, as it is available only to managerial levels.

> ***Company A**: "We don't have any incentive." (Packaging development coordinator)*
>
> **Company A**: *"It's not for everyone but for managers." (Corporate brand manager)*

Company B acknowledged individual's sustainability achievement through annual awards but this is not accompanied by financial incentives. On the contrary, individual or team's contribution to economic growth does get financial rewards every year.

***Company B**: "We have annual incentives on the financial achievement. For sustainability, we give awards every year." (Sustainable growth director)*

While both companies agree on the necessity of the incentive, either there was not equal chance for all the employees or the achievement is not acknowledged with a proper financial reward. This may indicate less emphasis toward sustainability than economic growth in Company B.

Table 4.1 summarises the quantitative data gathered regarding senior management support. In Company A, the perception of importance of senior management support is higher than the actual frequency. The effectiveness is the lowest of all three parameters. However, the coefficient of variance is insignificant by 18%[5].

Table 4.1 Summary of quantitative data in senior management support in Company A, B[6]

Senior m. supp	Importance	Frequency	Effectiveness	Mean±S.D.	Co.Var.
Company A	4.49	4	3.86	3.03±0.54	18%
Company B	3.59	3.9	3.52	3.33±0.33	10%

In Company B, the overall score of three parameters are lower than Company A and Company B's coeffient of varience is even less significant than Company B.

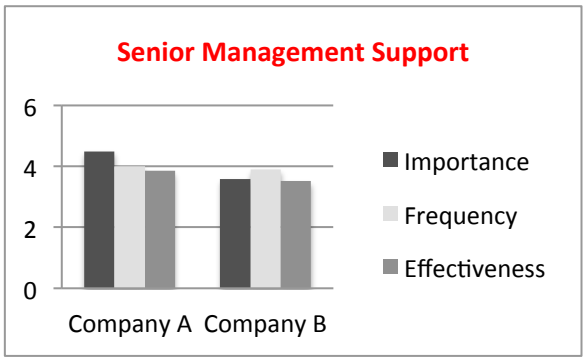


Figure 4.1 Tendency of three parameters of senior management support in Company A, B

[5] ≤20% is deemed as significant in this research.

[6] The numbers in Table 4.1 to 4.10 are the mean of seven interview answers to the respective questions. As described in Section 3.5.2 (see also Appendix C), the quantitative questions employ a 1-5 Likert scale format indicating the level of agreements from never (1), to neutral (3) and always (5).

Figure 4.1 shows the graphical tendency of the perception and implementation of senior management support in each company. Company A shows a typical descending pattern from left to right visualising the fact that the actual practice does not cater for the perceived importance.

On the contrary, Company B's result is highest in the middle which means that senior management support is more freqent than necessary, and not as effective.

Interestingly, lower level employees tend to consider the attentions from senior managers as interference rather than support. This is due to the regional context of Far Eastern Asia where hieratical orders are strict and those at the lower level are supposed to be obedient to higher levels.

> ***Company B**: "They'd be better not to care about details." (Project communication coordinator)*
>
> ***Company B**: "I wish they wouldn't pressurize us and don't care too much about details. In terms of sustainability, they can give the big picture about what to do. But if they tell us 'do this, do that', it become difficult to imagine other than that." (R&D researcher)*

Key elements of senior management support

- **Firm sustainability leadership** is the foremost elements for a strong senior management support.
- **Understanding of sustainability principles** is recommended.
- **Rewarding individuals for sustainability achievement** is an effective way of senior management support.

4.3.2 Factor 2: Sustainability vision

Supporting Azapagic's (2003) claim that the successful sustainability practice must emerge from and embedded into the business vision, this study provides empirical evidence for the need of a strong sustainability vision. The questionnaire initially examined how the company vision incorporates sustainability, and how sustainability vision is communicated during the NPD process. Two elements of sustainability vision were identified as: a) Alignment with company's general vision, and b) Dissemination throughout the company philosophy and daily activities.

a) Alignment with company's general vision

Company A reported an ideal alignment of sustainability vision with the company vision. All levels of interviewees expressed that sustainability is embedded in the corporate vision.

> ***Company A**: "The brand vision and sustainability **vision is the same**." (R&D personnel)*

> ***Company A**: "Company vision? Develop brands with a process that doesn't impact the environment as much as other brands. (Brand/marketing manager)*

> ***Company A**: "We have sustainability very much imbedded into our company brand vision and they are very interlinked. It's **difficult to separate**." (Strategic planning director)*

However, there is an awareness of the possible improvement of alignment level from the practice point of view.

> ***Company A**: "The alignment of vision? I think there is some room for improvement... The question of division of more technical/ tactical /strategic decisions divides the level of involvement." (Eco design manager)*

On the other hand, Company B shows very low level of alignment. Apart from a director level interviewee, five out of seven interviewees could not give an instant answer to the question such as " What is your company's sustainability vision?".

> ***Company B**: "Sustainability vision? Well. Let me have a look at my notebook… actually too many things are going on in our company… **I am not sure** if there is any vision related to sustainability separately." (R&D researcher)*

> ***Company B**: "Is having a sustainability vision important? **No**. It's getting bigger but we haven't set it up clearly. (Project communication coordinator) "*

> ***Company B**: "Probably there is something, as far as I understand. The vision seemed to have been proclaimed. But personally I don't really know." (Brand/marketing manager)*

In Company B, the general vision prioritises the financial growth.

> ***Company B**: "Profitable and continuous **growth is most important**. The biggest sin for a corporate is not being unsustainable but to be bankrupt." (Eco design manager)*

> ***Company B**: "Our biggest vision is to become the global top five in our sector by 2020." (Design manager)*

b) Dissemination throughout the company philosophy and daily activities

Company A shows a high degree of dissemination of sustainability vision in the company. It is repeatedly shown that sustainability is well communicated throughout the company.

> ***Company A**: "We **always talk about it** (sustainability). There is no way not to talk about it. We believe in this. We are born with this and living with it!" (Corporate brand manager)*

> ***Company A**: "How far do we want to go in sustainability? Having the vision, 'how do we apply it in a coherent way in our daily life?' That's something in my mind." (Strategic planning director)*

In contrast, sustainability vision has not permeated company B.

> ***Company B**: "There is hardly any talk about sustainability from senior management." (R&D researcher)*

> ***Company B**: "Sustainability element… to be honest, not all our brands talk about it. Although my brand talks about it, it's hard to say that we incorporate sustainability that much either." (R&D researcher)*

> ***Company B**: "Currently it's not very high. I heard that there is a gap between what the directors experience and employees experience." (Sustainable growth director)*

An employee level interviewee acknowledged the current state, and shares a hopeful future. Company B is understood to be at the introduction and experimental stage.

> ***Company B**: "In fact, there is not much about sustainability in the aforementioned vision, but we are trying to increase it gradually… Even though the sustainability brand is low-ranking internally, I guess we will grow it and it will have bigger influence on our sales and management." (R&D researcher)*

Table 4.2 illustrates the summary of the quantitative data gathered through questionnaire. Company A rated the full score (5) for the importance of having sustainability in their vision. The coefficient of variance among three parameters is remarkably low by 4%. This can be interpreted that the sustainability vision is well disseminated throughout the employees at every level. Company B scores slightly lower than Company A in every aspect. The quantitative data, however, does not indicate the fact that most of the interviewees in Company B are not aware of their sustainability vision let alone aligning them with the company vision.

Table 4.2 Summary of quantitative data in sustainability vision in Company A, B

S. vision	Importance	Frequency	Effectiveness	Mean±S.D.	Co.Var.
Company A	5	4.8	4.65	4.82±0.18	4%
Company B	4.43	4.17	3.78	4.13±0.33	8%

Figure 4.2 shows the overall tendency of three parameters are decreasing in both cases. Both A and B indicate the descending order from importance to frequency to effectiveness in sustainability vision matter.

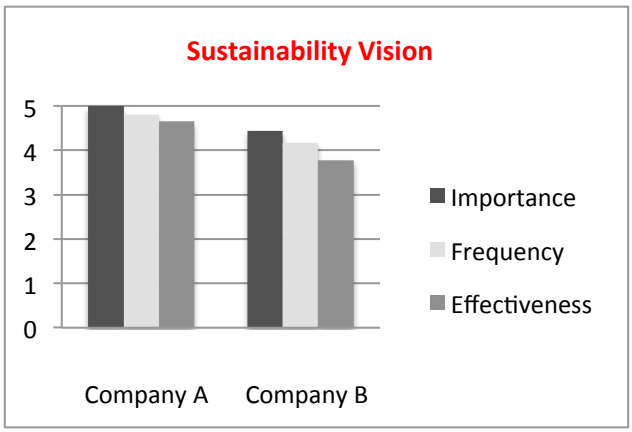


Figure 4.2 Tendency of three parameters of sustainability vision in Company A, B

Key elements of sustainability vision

- Sustainability vision is best when **aligned with company's general vision**.
- Sustainability vision is recommended to **disseminate throughout the company philosophy and daily activities**.

4.3.3 Factor 3: Internal communication

The importance of internal communication at various levels, contexts, and content has been emphasized several times in previous research. Lenox and Ehrenfeld (1997) and McAloone and Evans (1999) are some of the pioneering studies examining the communication issue from the sustainable NPD perspective, while Khurana and Rosenthal, (1998) and Kim and Wilemon (2002) argue that structured communication is critical in achieving efficient and effective NPD from the general NPD perspective (see Section 2.7.2). The qualitative data from both cases confirms the literature findings. However, in this study, the traits of internal communication only appeared in general NPD terms but no particular aspects in sustainable design implementation. The elements of successful internal communication were identified as a) Healthy inter-personal relationships, and b) Variety of channels. Company B appeared to be particularly content with their internal communication levels both formally and informally.

> ***Company B**: "Both formally and informally it's going very well. This company is quite strong in communication." (Technology manager)*

a) Healthy inter-personal relationships

To begin with, successful internal communication appears to be based on the quality of inter-personal relationships. The benefit of good inter-personal relationships for communication is demonstrated by business performance and outcomes.

> ***Company A**: It's all connected with internal communication. It's really complex as it's not technical but behaviour."(R&D researcher)*

> ***Company B**: "I can see that highly profitable products are from a team with a good relationship. Not only within the team but also factory workers, designers, researchers and sales persons are all in **good relationship**" (Project communication coordinator)*

> ***Company B**: "We are close to each other, and have lots of discussions and conversations." (R&D researcher)*

For better inter-personal relationship, Company B appointed a position for coordinating communication.

> ***Company B**: "I am in charge of the communication between R&D and marketing. I used to be an R&D researcher but recently dispatched to the marketing department in order to make the communication easier and build trust between functions. Now I go to the R&D office every now and then, and I spend most of the time sitting in the marketing team. This is the first case of such a role in the company." (Project communication coordinator)*

b) Variety of channels

The internal communication takes place in various ways. Frequent informal communications (e.g. casual conversations, frequent email exchanges, and text messages) can complement formal meetings. In company A, different level of interviewees had a contrasting view about their communication performance. While Eco design manager is content with the formal weekly meeting, lower level NPD members Such as Packaging development coordinator and R&D researcher were less satisfied with it.

> ***Company A**: "I think it works well because they meet every week. There is no problem in communication… There is no serious communication issue at the project level." (Eco design manager)*

> ***Company A**: "You have two-three hours to talk about the whole project but sometimes we had to focus on certain problems that were more important, then we didn't have enough time to share everything." (Packaging development coordinator)*

> ***Company A**: "Sometimes it's not so good. Sometime we start with a concept. And we change in the middle of the project. The communication does not go through. So we continue working with the old concept." (R&D researcher)*

Company B is a good exemplar in this regard.

> ***Company B**: "Rather than arranging formal meetings, we **casually exchange** ideas when we bump into each other or over lunch. So the **idea exchanges accumulate** which makes it easier when it comes to the actual development process, we go 'remember what I mentioned before, I want to develop it. Any ideas?'" (R&D researcher)*

Table 4.3, the summary of quantitative data demonstrates the satisfaction about internal communication in Company A and B. Company A shows slightly lower satisfaction in terms of the frequency and effectiveness. Effectiveness is the lowest of all. Company B shows better perception and almost same level satisfaction in internal communication. The coefficient of variance is remarkably low (1%).

Table 4.3 Summary of quantitative data in internal communication in Company A, B

ommunication	Importance	Frequency	Effectiveness	Mean±S.D.	Co.Var.
Company A	4.61	4	3.69	4.1±0.47	11%
Company B	4.57	4.5	4.62	4.57±0.06	1%

Internal communication is one of the rare factors that Company B outperforms Company A in terms of the perception and satisfaction alignment (Figure 4.3).

Key elements of internal communication

- **Healthy inter-personal relationships** form the basis of effective internal communication.
- **Variety of channels** is recommended to boost effective internal communication.

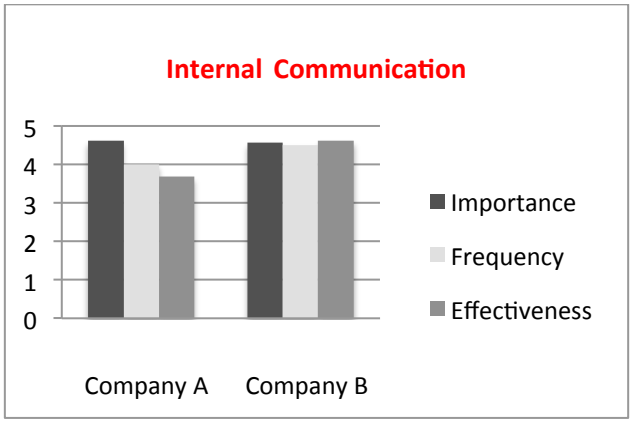


Figure 4.3 Tendency of three parameters of internal communication in Company A, B

4.3.4 Factor 4: Cross-functional team

From the early stages of the sustainability study, the importance of cross-functionality has been highlighted as well as in the general NPD research (see Section 2.7.3). The

first two quotes support previous studies, and highlight the importance of cross-functionality of NPD teams. However, a deeper look from the sustainable perspective into the details that were supposedly given as examples of cross-functionality raised questions in both cases. It is suggested in two elements such as a) Sustainability officer involvement, and b) Equal level engagement.

> ***Company A**: "Normally when we decide to start a project, a multi-functional team is created." (Eco design manager)*

> ***Company A**: "Considering sustainability especially, **simultaneous engineering** is very important… since the idea generation, all the people should be involved because we have to think from the early stage of the process how it's going to be transported, how much raw materials will be used… the sooner the better." (Strategic planning director)*

One noticeable observation in Company B was that the cross-functionality was so deeply embedded in their daily function that they don't consider the product development team as a separate team. The individuals rather show their explicit attachment to original function department, for example, design team 1,2,3, or marketing development team 1,2,3. This is partially due to the fact that the financial incentive for the achievement is awarded to the function departments, and partially due to the fact that most of their NPD processes are incremental and constant.

> ***Company B**: "We have a very well systemised structure of functions, so we don't need to create a team for a specific project. "A special TFT (task force team) is formed only in case of special occasions such as developing of a very innovative idea, or exploring new market or so." (Sustainable growth director)*

a) Sustainability officer involvement

A typical NPD project involves managing director, marketing/brand manager and personnel, Eco design manager and researcher, design manager and designer, supply

chain, manufacturing, and sales. However in neither of the cases did a sustainability officer (or sustainability expert) take part in the NPD process.

> ***Company A**: "The corporate sustainability manager is **not involved** in the NPD team. They are responsible for the interface between project team and sustainability. (Eco design manager)*
>
> ***Company A**: They are responsible for the measurement, the guideline, and the strategy." (Corporate brand manager)*
>
> ***Company B**: "There is a corporate sustainability team in the company. They provide the overarching framework and deal with **corporate level** sustainability issues. But they don't go to the individual brands [sic, NPD process]." (Sustainable growth director)*
>
> ***Company B**: "The sustainability officer gives the sustainability target and goals at the beginning of the project. Once the project takes off, we don't care about the process anymore." (Sustainability manager)*
>
> ***Company B**: "It seems valuable to have a sustainability officer in the NPD process." (Project communication coordinator)*

Consequently, this can cause the difficulty of implementing sustainability consideration from the early stages.

> ***Company A**: "But they are not in the product project team. That's the challenge." (Corporate brand manager)*

Particularly designer manager at Company B admitted that neither sustainability nor design is considered at the front- end of NPD.

> ***Company B**: "… it's only **at the rear-end** where it (design) goes in." (Design manager)*

***Company B**: "Including sustainability from the beginning? (Pause) Not vey high. According to the marketing needs, we sometimes add 'free' or 'organic' but we don't do this through cross-functional team." (Eco design manager)*

b) Equal-level engagement

Another equivocal element in both cases lied at the very first stage of NPD: Stage 0 (Idea Generation). In Company A, the Idea Generation stage is called 'Pre-Briefing' and it is the marketing department's sole task. Company B is not very different but a researcher takes part in at Stage 0 in addition to marketers.

***Company A**: "The first stage: pre-briefing is **only** within the **marketing**. Other people are not typically allocated in the first stage unless requested. Only the in briefing stage (stage 1) the full multi-functional team is located officially." (Eco design manager)*

***Company A**: "Mostly the marketing department is doing the first two parts." (Strategic planning director)*

***Company A**: "The brief and initiation come from the marketing." (Corporate brand manager)*

***Company A**: "Idea generation, only the marketing department does this." (Packaging development coordinator)*

***Company B**: "At the idea generation stage, ingredient composition is most important. So only after the brand manager, brand developer and a researcher formed the ideas in Stage 0, other functions join in… New product development brief comes **from the marketing** department." (Sustainable growth director)*

Apart from above two issues, both cases are content with their cross-functionality and effectiveness.

***Company A**: "I think we are the almost ideal cross-functional team."(R&D researcher)*

***Company B**: "Most of the time, we all work together. It's effective."*

Over all, perceived importance and actual practice are quite high and stable. The coefficient of variance stays within an insignificant range in both cases. (Table 4.4)

Table 4.4 Summary of quantitative data in cross-functional team in Company A, B

Cross-function	Importance	Frequency	Effectiveness	Mean±S.D.	Co.Var.
Company A	4.69	3.92	4.14	4.25±0.40	9%
Company B	4.45	3.79	4.26	4.17±0.34	8%

Figure 4.4 demonstrates sunken shape graphs in both cases. This is due to the less frequency at Stage 0.

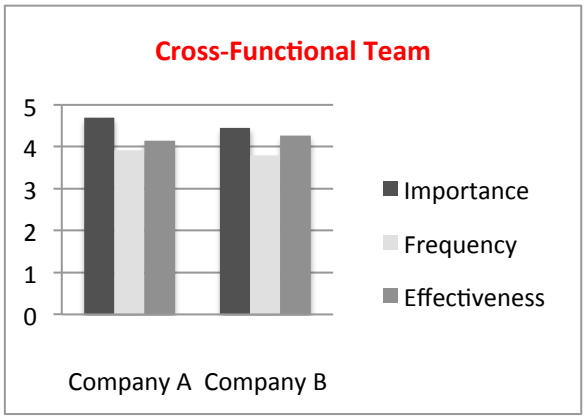


Figure 4.4 Tendency of three parameters of cross-functional team in Company A, B

Key elements of cross-functional team

- The **involvement of sustainability officer** in the front-end of NPD is recommended.
- **Equal level engagement** of all the related function is recommended.

4.3.5 Factor 5: Supportive corporate culture

Out of 10 key dimensions of corporate culture listed by Sackmann and Stiftung (2006) (see Section 2.7.4), in this study, interviewees' answers could be collated into six dimensions that are relevant to sustainability. The six dimensions are a) Transparency, b) Legacy, c) Behaviour, d) Belief, e) Structure, and f) Citizenship.

Company A and B understand the importance of supporting corporate culture of sustainability. The only director level interviewees from each case gave clear answers.

> ***Company A**: "Sustainability has to be embedded and permeated in all the expression of culture. It should be always present." (Eco design manager)*
>
> ***Company A:** "The culture that fosters sustainability is very important. More than just guidelines and pressure, it's about **vision and principles**." (Strategic planning director)*
>
> ***Company B**: "I think it's inevitable. It's neither forced, nor adjunctive. We need the culture that everyone understands and shares the belief that sustainability is essential to the organisation. Once such supportive corporate culture is formed, decision criteria will follow." (Sustainable growth director)*

a) Transparency

Both cases sport their clear emphasis on transparency. For Company A, transparency is so important that their office buildings and factories physically reflect the value by using glasses and all the activities and facilities are visible to everyone.

> ***Company A**: "We are **committed to the truth**, so transparency is one of our values. When the architect designed the buildings, he used … glass to promote two things: one, to communicate the value of the company; two, to give not*

only the vision of the nature but also to allow consumers and visitors to see the company."(Sustainability Eco design manager)

***Company A**: "Not only the building, also on our packaging, we have the Environmental Table… some of the table (sustainability analysis results) is not the best one… Only 40% is recycled. We are very honest… It's an ethical principle."(Strategic planning director)*

***Company B**: "For sustainability, there is nothing more important than transparency." (Sustainable growth director)*

b) Legacy

This research proposed its own definition of legacy in sustainability as 'the accumulation of sustainability practices within the company over a period of time'. Both companies have a good track record of sustainability practice over the history of four and six decades respectively.

***Company A**: "The company was **born 40 years ago**, with all the ideas of sustainability… There wasn't even such word 'sustainability' being used [sic]. But it was already there. So that's the foresight." (Strategic planning director)*

***Company A**: "We are the pioneers and protagonists as early as 2000, we structured this when everyone was talking about social responsibility, we already were talking about sustainability in a broader and holistic way." (Corporate brand manager)*

***Company B**: "We want to do it properly, even if it takes long… It's been 30 years since we started the tea farm. It took us over 14-15 years to cultivate the wilderness. Sometimes it doesn't help the business right now. But our principle is to take slow steps one by one in almost everything we do." (Sustainable growth director)*

***Company B**: "The company has been working with a number of charity bodies even before I started working here seven years ago. At least that aspect is well embedded in our company culture. For employees, company provides many opportunities for charitable volunteer jobs. Although it's mandatory for employees to take part, we willingly participate. It's actually nice to have such a system; otherwise it would have been difficult to do of my own accord. It's fun and rewarding." (Project communication coordinator)*

c) Behaviour

During the company visit, many sustainability-related activities for employees were observed especially in Company A. From the environmental perspective, carpooling to work was encouraged by company and commonly practiced by many workers. Also people voluntarily carried their own mugs to reduce disposable cup usage. From the social perspective, company's cafeteria that serves freshly cooked meals with several options was equally open to everyone at a nominal monthly payment. Everyone from executives to office and factory workers enjoy the same healthy food in the same space altogether. Not only the cafeteria, but also a day-care centre for employees' children and complimentary sports centre were available to all employees. Also company hired an external trainer who comes in to the office and run 10 minutes stretching session for improvement of office workers' health. These simple activities are small but powerfully reflect their passion and form the culture over time. In conjunction with the internal behaviour, Company A is well aware of their corporate behaviour towards the outside world. The below quotes from the Strategic planning director and corporate brand manager echo this aspect.

***Company A**: "Passion for relationship, cosmetics, products, and corporate behaviour: these elements define who we are… Things we do such as sharing benefits with communities, involving communities in what we do... The relationship with the communities is… the way we want to be related to the world, and what we want to cause in the world." (Strategic planning director)*

> ***Company A**: "We want to deliver value in product channel and corporate behaviour. Others usually don't have corporate behaviour as value proposition. But for us they have a same value." (Corporate brand manager)*

Company B sponsors an independent environment conservation research foundation and youth environmental activities programme at a brand level. Each sub-brands run different societal programme according to the brand's identity.

> ***Company B**: "We try to source our ingredients from our own fair-trade system. And it's been a decade since this brand started a charity for breast cancer, and a charity film festival is held by another brands... each brands are trying to develop their own community programme." (Sustainable growth director)*

d) Belief

Interviewees were also asked about 'commonly held beliefs, attitudes and values in sustainability'. Company A provided explicitly clear answers to express their belief in sustainability.

> ***Company A**: "The belief is in sustainability. We believe that life is a chain of relationship… We believe in the beauty as a very legitimate will of human being… We believe company is a living organism, ecosystem… is always evolving, changing and the company has a role as in the society. It is a transformation agent." (Corporate brand manager, company A)*

> ***Company A**: "We **exist for sustainability**." (R&D researcher)*

> ***Company A**: "We think about consumers but always think about **sustainability the most**." (R&D researcher)*

Company B's belief about sustainability was different. It was generally customer based. See the below quote from the corporate sustainability manager.

> ***Company B**: "I believe sustainability must be applied in accordance with what our customer values." (Corporate sustainability manager)*

***Company B**: "One of the reasons why we adopted sustainability is to give a good impression to our customers. This is related to the company's profit…" (Brand manager)*

e) Structure

Interviewees at Company A agreed that their sustainability practices are less structured.

***Company A**: "… not consistent... not in uniform… We try to diagnose on the portfolio sustainability… But we had difficulties, as there is no uniformity. It's not standardised, it's not a formal process... We connect much more naturally not formally." (Corporate brand manager)*

***Company A**: "some of them are formal and other are less formal." (Eco design manager)*

***Company A**: It's not totally structured. We are all the time learning and it changes every time." (R&D researcher)*

After all, unstructured nature is perceived as a challenge to tackle in Company A. There is a tendency to build up the structure in sustainability practice.

***Company A**: "Things used to happen very much intuitively, based on the leadership profile. Now we have to formalise the process. How do we have it very structured, it is our challenge. Now we cannot be dependent only on the intuitive and strong leadership we used to have. (We need) common and easy accessible source of knowledge, guideline and directions [sic]." (Corporate brand manager)*

In Company B, corporate level director/ manager and project level managers / employees showed confidence in their high level of structure.

***Company B**: "We have set up a quite good framework formally. Although it wouldn't be comparable to global top corporates, we are quite systemised… The*

company runs sustainability related project every year and the sustainability committee regularly present to the executives."(Sustainable Growth director)

***Company B**: "We are quite structured in our own way." (Eco design manager)*

On the contrary, project level managers and employees who take part in the NPD processes, diagnose their sustainability processes as less structured.

***Company B**: "We are less structured." (Design manager)*

***Company B**: "It's quite formal but we are trying to structure it." (Brand manager)*

***Company B**: "No, it's not structured." (R&D researcher)*

f) Citizenship

Company A and B all acknowledged the importance of acting as the leading lights to society. In some cases of Company B, they even endured a financial loss to a certain degree.

***Company A**: "It sounds arrogant to change the behaviour because the society is not easy to change. However you can start to move... That's what we are doing." (Strategic planning director)*

***Company B**: "We would rather focus on being a good citizen than money. In many cases, the recycled polymer is more expensive than the virgin material. It costs more for labour. Let's say we go for it even if it's less profitable. It's all because of the corporate citizenship." (Design manager)*

The summary of quantitative data in Table 4.5 indicates that both cases are healthy and content regarding the corporate culture of sustainability with high mean (Company Company A: 84%, Company Company B: 82%), and low coefficient of variance of 8%, and 5% respectively.

Table 4.5 Summary of quantitative data in corporate culture of sustainability in Company A, B

Culture	Importance	Frequency	Effectiveness	Mean±S.D.	Co.Var.
Company A	4.63	4.1	4.02	4.25±0.33	8%
Company B	4.41	4.11	4.06	4.19±0.19	5%

Be that as it may, interestingly the quantitative representation of corporate culture for sustainability does not fully reflect the current state of case companies. Whereas the qualitative analysis depicts the some differences between two case companies, two graphs in Figure 4.5 resemble each other in terms of the height and patterns.

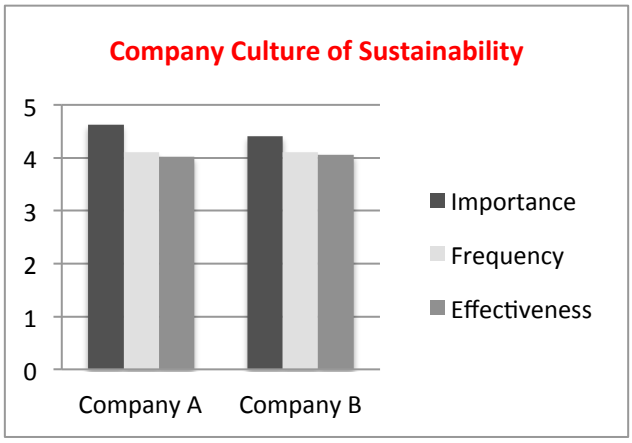


Figure 4.5 Tendency of three parameters of corporate culture of sustainability in Company A, B

This is one of the cases of inconsistent appearance of qualitative and quantitative

Key elements of corporate culture of sustainability

- **Transparency** of company's sustainability practice
- **Legacy** of sustainability practices throughout the company's history
- **Behaviour** of sustainability
- **Belief** in sustainability practice
- **Structure** of sustainability practice
- **Citizenship** towards the society

analysis, and mainly attributed to the intangibility of the subject matter.

4.3.6 Factor 6: Individual attitude

While corporate culture is a collective notion, individual aspects of employees draw an attention from a different angle. This study articulates Individual's committed attitudes towards company's sustainability practice in the temporal order such as a) **Motivation** based on the company's **past** sustainability practice, b) **Satisfaction** about company's **present** sustainability practice, and c) **Ambition** about the company's **future** sustainability practice.

a) Motivation based on company's past sustainability practice

For Company A, high motivation was observed in every single interviewee from the director to the junior researcher. People were proud about working for the company and what the company has been doing.

> ***Company A****: "Everybody comes here to make a difference, to make a better world. I strongly believe that's what inspired people to join us." (Corporate brand manager)*
>
> ***Company A****: "Every time I talk about sustainability,* ***I become very excited****." (Corporate brand manager)*
>
> ***Company A****: "It (sustainability) motivates people and make the employees proud." (Eco design manager)*

Many people were found to pursue sustainability in their work and life voluntarily.

> ***Company A****: "I almost work only on sustainable design [sic]. This is my job and my activity and my weekend!" (Eco design manager)*
>
> ***Company A****: I bring it to my work voluntarily. I am not a sustainability professional, but bring the value, which is inside me… I develop it (a brand) in a sustainable way. It's a kind of personal effort. I try to bring it (sustainability) to everything I do." (Marketing manager)*

> ***Company A**: "People are **very engaged** here. The essence of this company is very strong." (Corporate brand manager)*

In an extreme case, even for a junior level, motivation was almost taken for granted.

> ***Company A**: "Motivation? Sustainability is not about motivation but a requirement... they are **already motivated anyway**." (R&D researcher)*

Dissimilarly, Company B's individual motivation rate varied. It appeared quite high in the director level and corporate level.

> ***Company B**: "Internally, we are trying to continue doing it as much as we can." (Sustainable growth director)*

> ***Company B**: "Rather than treating sustainability as a differentiating factor, I believe every brand should practice it... We may well do so for the sake of the Earth, may we not?" (Brand manager)*

> ***Company B**: "I personally think it's important." (Corporate sustainability manager)*

However, scepticism appeared towards the lower level of hierarchy, and the motivation level decreased.

> ***Company B**: " I personally **don't think** it's (sustainability) **important**. If it doesn't work well or consumers don't like it, they seem to think we should go back to our old solutions." (R&D researcher)*

> ***Company B**: "We cannot sacrifice others (profitability, function, or the appearance of the product) for sustainability." (Design manager)*

> ***Company B**: "There are lots of conflictions internally. Some of us say "Do we really need to do that? Rather than paying that much money, reducing the cost and lower the product price will be more beneficial to consumers." (Sustainable growth director)*

b) Satisfaction about company's present sustainability practice

Again in Company A, the satisfaction about what the company is doing was fairly high.

> ***Company A****: "How the miracle happens! How the magic happens! It's a* ***miracle****. I believe it's because of the very [sic] special and engaged people." (Corporate brand manager)*
>
> ***Company A****: "The ways and the solutions that we promoted were quite successful and well accepted by the initiative who sponsor that (the senior managers)." (Eco design manager)*
>
> ***Company A****: "It's really good to work in this company." (R&D researcher)*

Company B has contradicting perspectives, not very content with the current state both at the corporate level and project level.

> ***Company B****: "Relatively, our sustainable design is not so strong… compare to the global top companies, no matter how well we do, we would only score 60-70 out of 100... But in terms of the confidence that we can do better than before, it's quite effective." (Sustainable growth director)*
>
> ***Company B****: "No, it (sustainable design implementation) is neither frequent nor effective." (Project communication coordinator)*
>
> ***Company B****: "I don't think we have any genuinely sustainable designs yet. We are not there yet, in terms of minimising the environmental impact, recycle after use, etc. Not many (of our) brands are doing it 100%"(Brand manager)*

c) Ambition about the company's future sustainability practice

Interviewees throughout Company A, although they are proud of the company and happy with today's achievement, they aim high and want to stretch even further.

> ***Company A****: "what you've done today is better than what you've done yesterday. But it will be worse than what you are going to do tomorrow." (Strategic planning director)*

***Company A**: "I always try to find new solutions and new possibility to innovate with sustainability solutions… So it's not comfortable to give the same ideas for similar sustainable problems." (Sustainability Eco design manager)*

***Company A**: "I'm much more ambitious. Of course, it has to be extra ordinary, not ordinary... Because they (employees) can change the world, they can make a difference. "(Corporate brand manager)*

***Company A**: "We can change how people think. We are the **opinion formers**." (R&D researcher)*

Company B showed a taste of ambition for the future. It stayed in the personal level.

***Company B**: "We should try harder so that we can present ourselves more confidently and genuinely… Aren't we at the embryonic stage yet?" (Brand manager)*

***Company B**: " I personally wish to make the world a better place than what it has been before I was born. I will continue working as a designer, and do some sustainability deeds at this position."*

In the summary of quantitative data (Table 4.6), the perception of practice level of Company A is quite high as described in the above qualitative data. Company B scored the second highest coefficient of variance by 25%, which demonstrates the considerable discrepancy between the perceived importance and their practice.

Table 4.6 Summary of quantitative data in individual attitude in Company A, B

Individl Attitude	Importance	Frequency	Effectiveness	Mean±S.D.	Co.Var.
Company A	4.98	4.26	4.16	4.43±0.39	9%
Company B	4.57	3	3.12	3.56±0.87	25%

Although Figure 4.6 shows a similar descending style in both graphs, the difference in the gaps in two graphs is clear.

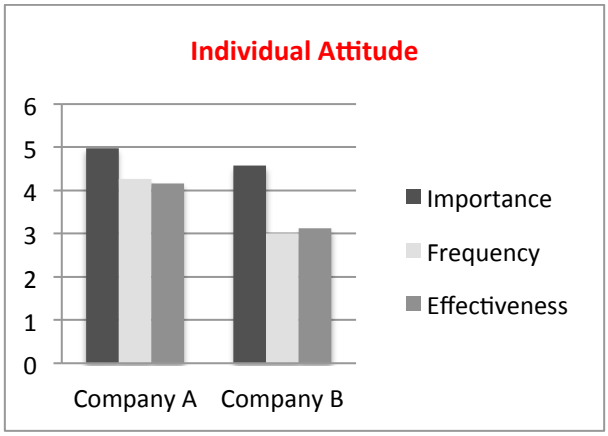


Figure 4.6 Tendency of three parameters of individual attitude in Company A, B

Key elements of individual attitude

- **Motivation** based on the company's past sustainability practice
- **Satisfaction** about company's present sustainability practice
- **Ambition** about the company's future sustainability practice

4.3.7 Factor 7: Sustainability champion

As discussed earlier in Section 2.7.7, the sustainability (project champion for NPD) champions make another recurring appearance over a number of studies. However, its importance has been controversial by different academics. The empirical studies showed the similar conflicting results.

For example four out of seven interviewees from Company A disagreed on the necessity of a champion.

> ***Company B**: "A champion is important as a focal point. Sustainability cannot be done by just one department solely." (Sustainable growth director)*

Then a project level design manager from Company B showed her scepticism toward such function.

> ***Company B**: "They are **putting us off**! (giggle) Because they say 'Not this, not that!'" (Design manager)*

What make the sustainability champion so controversial even within one company? This study suggests the following two reasons for this confusion: a) Project level involvement, and b) Official vs. voluntary.

a) Project level involvement

In case of an acknowledgement in Company A and B, the champion turned out to function at the corporate strategy level rather than at the project level.

> ***Company A**: "It's the director of sustainability and she has many managers working for different issues." (R&D researcher)*

> ***Company A**: "YES. We have a sustainability director. She is responsible for making sure that our sustainability objective is being achieved. She is the one with the guideline within the organisation. She is the senior director and she has the VP right now." (Strategic planning director)*

> ***Company B**: "Yes, when we develop a sustainable product, there is a separate department where they **set up rules**, and the other department where they confirm the project based on the rules. The rules are not only about the design but everything such as formula, and ingredients, etc." (Sustainable growth director)*

> ***Company B**: "There are only six of us in the Sustainability department. It's impossible for us to cover every project. Each of us is involved in 3-4 projects at a time to manage the process and tackle issues." (Corporate sustainability manager)*

b) Official vs. voluntary role

The suggested description of the sustainability champion in the questionnaire (i.e. official, project involvement, and middle manager level position), which is extracted from previous research (see Section 2.7.7 and Appendix C), caused confusion in judging whether they have such a person or not in both companies. Four out of seven interviewees at Company A denied its official existence.

> ***Company A**: "Sustainability is an official goal but there is no official person." (Marketing manager)*
>
> ***Company A**: there is **no official person** within the company. I think we should consider it!" (Packaging development coordinator)*

Similarly, five out of seven interviewees at Company B didn't acknowledge the sustainability champion.

> ***Company B**: "No, if you ask me if such a person appointed for projects in our company, my answer is no." (Corporate sustainability manager)*
>
> ***Company B**: "I don't think we have one. But we may need one, I guess." (R&D researcher)*

Meanwhile, some believed that there is such a person and some argued that they are the one who play such role.

> ***Company A**: "I AM this person. But it's not official. People look at me and think I am a brand manager and work on sustainability… I bring it to my work voluntarily." (Marketing manager)*

In fact, Company A rather argued about the ultimate necessity of sustainability champion at the fundamental degree. Although, per se, deeper involvement of the sustainability champion at the project level is highly recommendable, one interviewee argued that sustainability also should be an unquestionable goal just as quality or performance.

***Company A**: "Sustainability is as important as cost and performance… You don't have a champion for quality or performance. It's everyone's responsibility!" (Eco design manager)*

***Company A**: "The ideal will be, we do not need this person anymore. If everyone has this idea so crystalised and motivated… the dream will be everything is so in the mind of everyone…" (Strategic planning director)*

As a consequence of the conflicting answers, the summary of the quantitative data also shows unusual patterns (Table 4.7).

Table 4.7 Summary of quantitative data in sustainability champion in Company A, B

S. champion	Importance	Frequency	Effectiveness	Mean±S.D.	Co.Var.
Company A	3.53	4.67	4.48	4.22±0.61	14%
Company B	3.8	2.5	2.98	3.09±0.66	21%

The perceived importance of sustainability champion is relatively lower than usual in both cases (Company A: 70%, Company B: 76%). In case of Company A, the frequency abruptly increased (92%) and the effectiveness is in between (89%). Company B rated importance the highest but it is not much higher than Company A. In the meanwhile, frequency and effective are exceptionally low, scoring a significant coefficient of

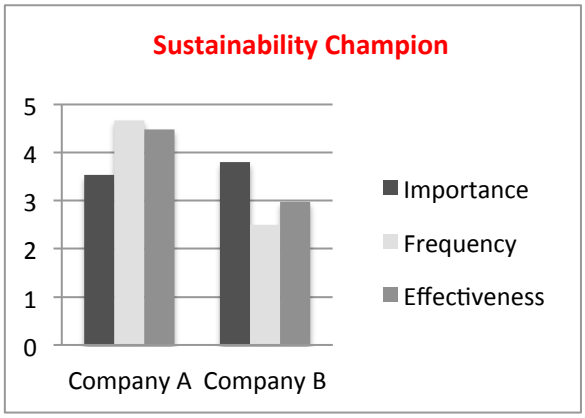


Figure 4.7 Tendency of three parameters of sustainability champion in Company A, B

variance by 21%.

Figure 4.7 also shows unique graphs of random patterns. This reflects the fact that sustainability champion is not a consented issue both in academia and industry.

Key elements of sustainability champion

- **Project level involvement of** sustainability champion is recommended.
- Sustainability champion can be an **official role or a voluntary job.**

4.3.8 Factor 8: Sustainability tools

While numerous sustainability academics agree on the potential effectiveness of tools, others show their concerns about the implication of those tools in industry (see Section 2.7.6). The empirical data illustrates the similar contrasting outcomes. Nevertheless, this section argues following two aspects for successful sustainability tools: a) Customisation for company context, and b) Timely introduction.

Firstly, Company A reveals their fundamental belief in the full use of tools in the NPD process.

> ***Company A****: "It's very important. We should use the tool to approve the gate of the prototype stage, you have to calculate the amount of the emission." (Sustainability Eco design manager)*

> ***Company A****: "The real problem is if the tool is used in-depth… The success factor is how popular and effectively it is used." (Eco design manager)*

On the other hand, a director and the corporate sustainability manager were aware of their own tools and its importance.

> ***Company B**: "It's very important. We give priority to it from the idea generation. As we must decide whether the product will be abided with the tool or not, we shall use it from the Stage 0 and all other stages, too." (Eco design manager)*

But in general Company B has not explored the potential benefits of appropriate tool usage. Some project level argued that they do not use any tool.

> ***Company B**: "No! We don't have any tools. We don't' use it!" (Brand manager)*

> ***Company B**: "Tool is not important… It's **only for the paperwork**. I don't expect from it too much. I personally am not a fan of tools. We should have a consensus and consider it from the beginning of the project. That will be more important." (Design manager)*

> ***Company B**: "I know that tool is important but we don't have any good example of using it yet." (Sustainable growth director)*

Tools are considered merely as an add-on marketing media. But the marketers do not have knowledge or anticipation about tools.

> ***Company B**: "A tool is basically for the better communication with consumers. It's like adding an accessory on the product." (R&D researcher)*

> ***Company B**: "I'd say it's more about how we can communicate with our customers with tools… I wish there were. But we don't have one yet." (Brand manager)*

> ***Company B**: "Marketers don't even know what LCA is. They think analysis tools are useless." Company B: "From the big picture, it doesn't have much influence on the development process. But we can refer it… first of all we must make sure that our customers can have a clear idea about what it is." (Project communication coordinator)*

a) Customisation for company context

Both companies agreed on the necessity of customising pre-developed tools to fit into the company context. Company A is fully utilizing a range of tools from pre-developed, customised or their own ones[7].

> ***Company A****: "You want to claim that you are sustainable, but in the daily basis in reality you are not. So you have to develop better tools, or better guideline for R&D." (Sustainability Eco design manager)*

> ***Company A****: "There are not so many in the front-end. Most tools are specific or experimental project. It's not applicable in the current project." (Eco design manager)*

> ***Company A****: "We have a series of guidelines that you must follow throughout the process from stage 0 to 2… to have an eco design product. The series of guideline gives you boundaries in which you will think about your materials, ingredients, recyclability, and usage to avoid waste, energy consumption during production... So we are working on this very well articulated guideline so that everybody will be able to follow." (Strategic planning director)*

Company B has their own tools, too. While the corporate level director and manager acknowledge them, the project level interviewees didn't appear to know or use them (see above).

> ***Company B****: "We've developed a tool in collaboration with the Government. We helped them to lead the project." (Sustainable growth director)*

> ***Company B****: "For stage 0, we have Sustainable Product Guideline and Sustainable Design Guideline. About 15% of our products are eligible for these… This is an overarching guidance at the corporate level and they should follow before the NPD begins." (Corporate sustainability manager)*

[7] For confidentiality reasons, the specifications of the tools cannot be provided.

***Company B**: "XXX (company's own tool) is very important. We first decide if we want the product to fit into it." (Eco design manager)*

***Company B**: "There is one that we've **developed ourselves** to assess the materials we buy. We've been using it since 2011 to give grades to materials we source. It us applied to all the products." (Corporate sustainability manager)*

b) Timely introduction

A further issue is the introducing sustainability tools at appropriate time. Especially in the FMCG environment, where the average span of a NPD process is relatively short, as the title of the sector 'Fast-Moving-Consumer-Goods' suggests.

***Company A**: "You have to give them the right tool… from the beginning so that everyone has the same orientation to deliver the project… You can generate better ideas… if you have the project and have to add sustainable guidelines afterwards, it will take more time." (Sustainability Eco design manager)*

***Company B**: "We use it after the prototype is made. If we could have embraced it from the beginning with all the developers, we could have come up with less flashy but more considerate packages." (Design manager)*

Table 4.8 presents a dramatic disparity of two companies' coefficient of variance. Company A shows only 0.50% while Company B is 26%. Unlike other factors, this table only compares the importance and effectiveness. Overall perception of importance of sustainability tools and its effectiveness are high in both cases. This can be interpreted as that the reality is satisfying the expectation.

Table 4.8 Summary of quantitative data in sustainability tools in Company A, B

S. tools	Importance	Effectiveness	Mean±S.D.	Co.Var.
Company A	4.14	4.17	4.16±0.02	0.50%
Company B	3.76	2.59	3.18±0.83	26%

In case of Company B, as shown in Figure 4.8, both the perceived importance and effectiveness are lower than Company B. Especially the effectiveness is as low as 2.59 resulting the biggest coefficient of variance (26%) of all factors presented in this study.

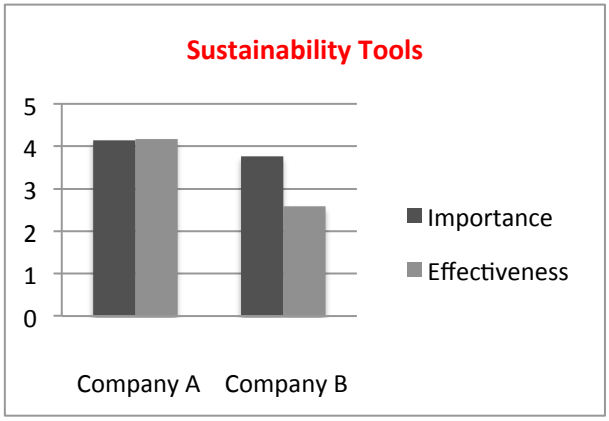


Figure 4.8 Tendency of two parameters of sustainability tools in Company A, B

Key elements of sustainability tools

- **Customisation of sustainability tools** is recommended to fit in the company context.
- **Timely introduction** of the tools is critical in its successful utilisation.

4.3.9 Factor 9: Clarity of sustainable design terminology

Unconsolidated usage of a variety of terms from 'green design', 'eco design', 'sustainable design', 'design for the environment (DfE)', 'environmental conscious design', and 'life cycle engineering' to 'clean design' is conspicuous both in academia and industry (see Section 2.6.4). With an assumption that the clear terminology can reduce confusion among the NPD team members and help better sustainable design implementation, the empirical study explored the most commonly used terminology,

and typical design emphasis. This is to assess the application of the academic definitions in the industrial practices. The elements can be divided into a) Agreed definition on sustainability terminology, and b) Sense of sharing the same goal.

a) Agreed definition on sustainability terminology

The perceived importance of using an agreed sustainability terminology was rather inconsistent both in Company A and B. The below shows the contrasting views about the need for a clear sustainable design terminology. In both companies, a slightly larger number of people disagreed on the importance of clear terminology than agreed.

Some advocated the necessity of clear terminology both in Company A and B.

> ***Company A**: "In order to make sure that you achieve a good result, it's important. To guarantee that all the related people will have the same understanding."(Sustainability Eco design manager)*
>
> ***Company B**: "Even if we use a same word, what a sales person understands can be different from that of R&D researcher, marketer or a designer. In order to avoid this happening, we tried to have agreed definitions. So it's very important." (Sustainable growth director)*
>
> ***Company B**: "I think we should use an agreed one. It will suggest the overall direction. It will prevent the project going to the wrong direction. In many cases, a project goes to a wrong direction during the NPD process." (Project communication coordinator)*

On the other hand, some argued what they mean comes first, more than anything.

> ***Company A**: "It's not about the word but meaning of the concept." (Eco design manager)*

***Company A**: "Using different terms is not as important… if you understand the principles behind those terms." (Strategic planning director)*

***Company B**: "They all sound the same."(Corporate sustainability manager)*

***Company B**: "Isn't knowing the meaning be enough? To be honest, it all seems like wordplay." (Brand manager)*

However one interviewer from Company B emphasised the clarity of a specific terminology, e.g. not using 'consumers' but 'customers'.

***Company B**: "We don't use 'consumer' but 'customer'." (Eco design manager)*

Hence the undiscovered necessity of clear sustainability terminology can be claimed.

b) Sense of sharing the same goal

Both cases argued that sharing the same goal is important than having an official set of agreed terms.

***Company A**: "The more important is [sic] to have **common definitions**…we should know what we are talking about." (Strategic planning director)*

***Company B**: "**Understanding its exact meaning** is much more important. Rather than the term, if what I mean by green is different from what our customers think, that will be meaningless." (Brand manager)*

The above two seemingly legitimate claims are, however, refutable, as common understanding of a certain concept should entail a common nomenclature. In essence, to convey a meaning one needs grammatical or lexical devices of language.

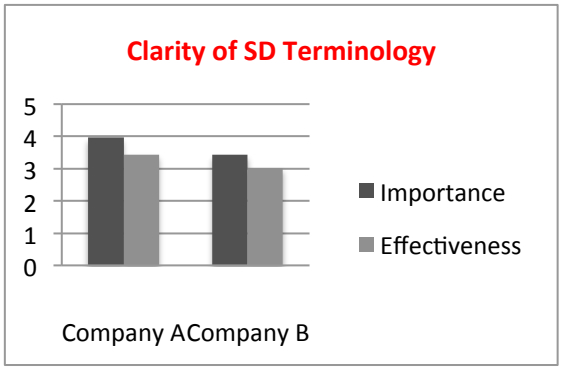
Table 4.9 illustrates that both perceived importance and effectiveness are not quite high in both companies.

Table 4.9 Summary of quantitative data in Clarity of sustainable design terminology in Company A, B

Clear terminol	Importance	Effectiveness	Mean±S.D.	Co.Var.
Company A	3.96	3.43	3.70±0.37	10%
Company B	3.43	3.02	3.22±0.30	9%

Figure 4.9 shows the similar descending patterns in both companies.

Figure 4.9 Tendency of two parameters of Clarity of sustainable design terminology in Company A, B



In this phase, the most commonly used terminology, and typical design emphasis were asked. The aim is threefold: a) to examine the level of confusion cause by mixed and ambiguous usage of terms, b) to measure the impact of the mixed usage in the FMCG context, and c) to identify the reflection of the academic definitions of different terminology in industry.

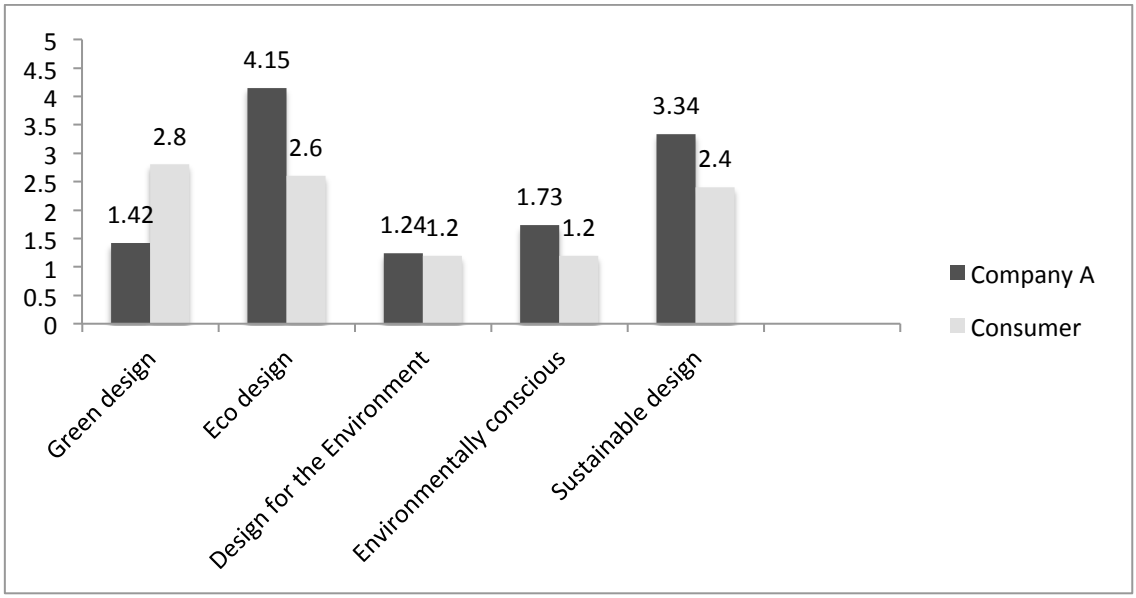


Figure 4.10 Comparison of most frequently used sustainability-related design terminology by company and consumers in Company A

Figure 4.10 shows the frequency of using different terms in Company A. Firstly, the most frequently used terminology was asked among the company, and consumers. The answer samples ranged from green design, eco design, design for the environment, and environmentally-friendly design, to sustainable design. Figure 4.10 shows that the company most commonly uses 'eco design' (4.15) whilst 'green design'(2.6) is most common by consumers. The second common one among the company is 'sustainable design' (3.34), and 'eco design' closely follows 'green design' by consumers. By both the company and consumers, 'design for the environment' was least popular.

Secondly, the design emphasis was separately asked. The hidden purpose of this question was to examine whether the definition of each terminology was correctly understood and used by industry. Although three answers were almost evenly chosen, the most common emphasis was 'design that considers the environment, society, and economic advantages holistically.' By 39%. The second popular one was 'design that tackles all the environmental impact across the product life cycle' (34%). The least common one was 'design focusing on a single environmental issue' (27%). (See Figure 4.11)

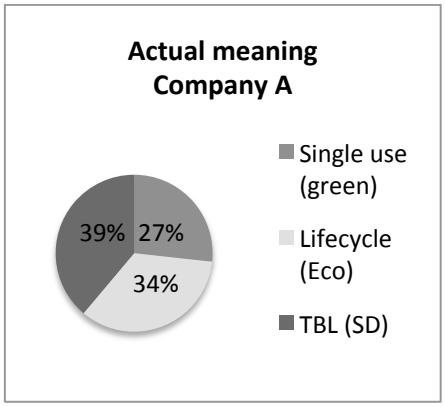


Figure 4.11 Design emphasis in Company A

The combination of these two questions shows a slight discrepancy between the terminologies and academic definitions. While 'eco design' is mostly used, the most common emphasis that Company A actually means 'sustainable design' by academic definition. However, 'sustainable design' came the second by terminology usage and the eco design definition ranked the second in usage. In other words, Company A's terminology usage and the matching rate with academic definitions were switched with each other.

In case of Company B employees' preference on the terminology, the difference among top three are so close by 3.73 (design for the environment), 3.7 (sustainable design), and 3.68 (eco design). In fact, ranking them in order barely shows any significant difference (Figure 4.12).

The popularity of 'design for the environment' is partially due to the language context. In Korean language, expression 'for the environment' (친환경) is commonly used to describe various environmental-related activities not only design. In the same vein, the customer's preference is unequally higher in 'design for the environment (4.5)' than others. 'Eco design' and 'green design' follow respectively (Figure 4.12). In academia, 'eco design', and 'design for the environment' are considered as a same concept. The former is more common in the Europe whilst the latter is prevalent in the U.S.

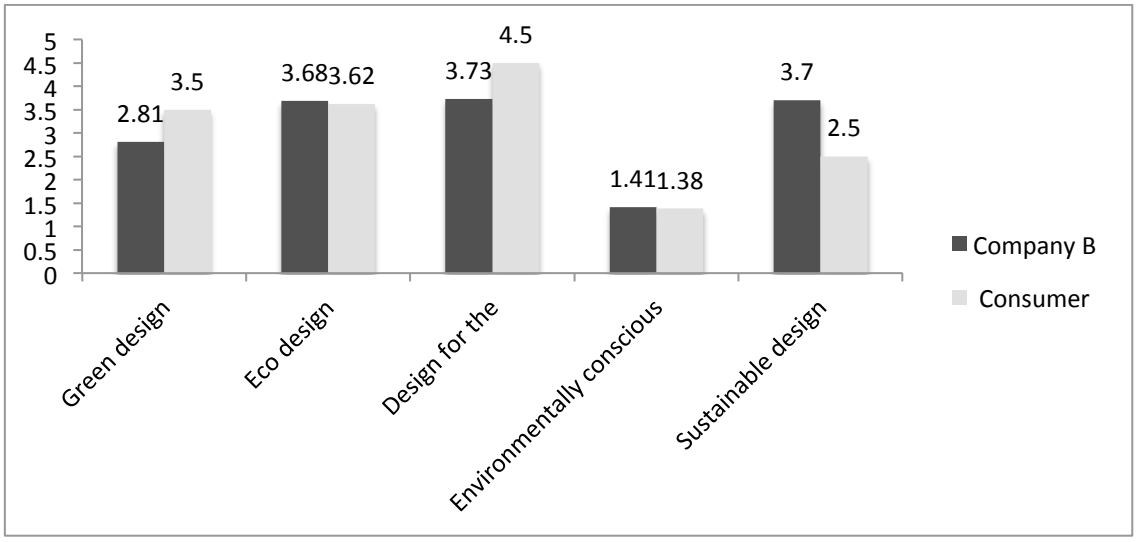


Figure 4.12 Comparison of most frequently used sustainability-related design terminology by company and consumers in Company B

In terms of the emphasis, Company B preferred the definition for 'green design' the most by 38%, and it is followed by 'sustainable design (34%)'. The least common design emphasis was the definition of 'eco design' (see Figure 4.13).

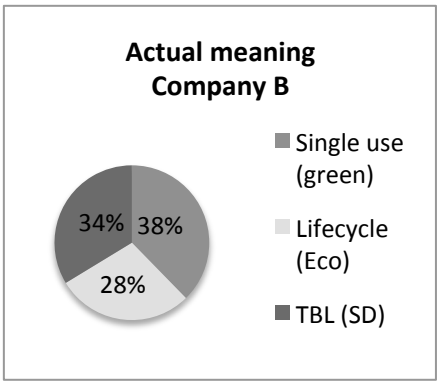


Figure 4.13 Design emphasis in Company B

This shows an interesting jump; while academia suggests that the concept has gradually evolved from green to eco and sustainable design over time, Company uses either 'green design' or 'sustainable design'. They seemed to have jumped 'eco design' period in Company B. However, in terms of the terminology and the definition disparity, their preference of terminology 'eco design, design for the environment or

sustainable design' slightly misalign with the academic definition (green or sustainable design).

The two comparisons between Company A and B's terminology preference difference of company and consumers, and the terminology usages and the academic definitions are reflecting the confusions between the consumer and company, and industry and academia.

Key elements of clarity of sustainable design terminology

- **Agreed definition** on sustainability terminology is recommended for better internal / external communication understanding of sustainability practice in the long-term.
- **Sense of sharing the same goal** is the ultimate role of the clear terminology.

4.3.10 Factor 10: Balanced focus on growth

One of the sections in the first research questionnaire was about 'consumer involvement', which is another commonly claimed factor both from the sustainable design research and the front-end NPD research (see Section 2.7.5). However, an unanticipated finding from Company A is the strong independence from consumer involvement.

> ***Company A**: "We need a certain degree of consumer involvement in these steps. But it is controversial in this company." (Strategic planning director)*

> ***Company A**: "In general we do not consider (consumers) [sic]. We do not involve them in the process to have their suggestions about the decision." (Sustainability Eco design manager)*

Company A: "I wouldn't say it (consumer involvement) is important. It's not the core innovation driver for us." (Corporate brand manager)

*Company A: "The seed is not the consumer, **never**." (Marketing manager)*

In contrast, Company B provides ample evidence to support the previous literature findings.

*Company B: "(Consumer involvement is) Important. Most of the product concepts derive from consumer insights... **Consumer is the core success factor**… After all, consumers influence every stage." (Sustainable growth director)*

Table 4.10 suggests the relatively low perceived importance and realisation in practice in both cases. The means in both Company A and B are 3.03 and 3.33 respectively. Although coefficient of variance is higher in Company A (18%) than Company B (10%), both are within the insignificant range.

Table 4.10 Summary of quantitative data in Consumer involvement in Company A, B

Consumer invo	Importance	Frequency	Effectiveness	Mean±S.D.	Co.Var.
Company A	3.58	2.5	3.02	3.03±0.54	18%
Company B	3.65	3	3.33	3.33±0.33	10%

While the perceived importance is almost same in both cases, Figure 4.14 reveals lower frequency and effectiveness in Company A. This caused a bigger coefficient of variance and is supposed to be due to their substantial disbelief in consumer insights in Company A.

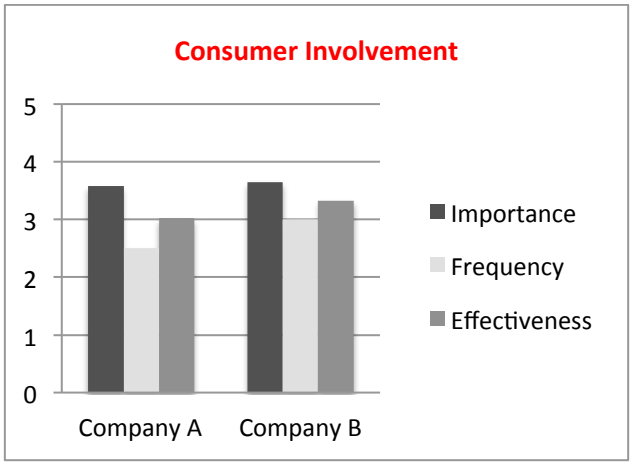


Figure 4.14 Tendency of three parameters of Consumer involvement in Company A, B

Summing up the above contrasting evidence from Company A and B, the current study made an exceptional decision about the subject matter. It has been decided to reinterpret the theme 'Consumer involvement' into 'Balanced Focus on Growth'. The former was the expression used in the questionnaire, and the latter is the reinterpretation of the former through the analysis. This is the only case of renaming the factor, as all other factors maintained the original themes from the questionnaire.

The background of this decision is threefold. First, consumer involvement is generally used to pursue growth, thus in itself does not necessarily contribute to sustainability. Second, rather, sustainability and growth can at times be antagonistic to each other. Growth is a much-debated topic in sustainability research, especially within sustainable development studies (for example, Daly, 1996). Third, therefore, growth needs to be checked by sustainable balance. Foremost focus on financial growth often causes an imbalance of the triple bottom line of sustainability: people, planet and profits.

Under 'Balanced Focus on Growth', the following elements are extracted from the transcription of the qualitative data. The six elements are: a) Careful balance of Triple Bottom Line, b) Balanced reliance on consumer insight, c) Equal sustainability emphasis in brand portfolio, d) Marketing dominance avoidance, e) Economy of scale flexibility, and f) Speed constraint flexibility.

a) Careful balance of Triple Bottom Line

Company A is an exemplary case of careful balance of TBL (as quoted in Section 4.4.1. C), their stress on balanced TBL is integrated into their company activities in various aspects, such as incentive systems, and the NPD approach.

> ***Company*** *A: "It (incentive system) is a combination of economical achievement, carbon emission, and the loyalty levels… It's* ***about TBL*** *and it (last year's growth) was not sustainable in social (aspect). So we didn't get the bonus. It's not that we had a terrible result but not enough in the three dimensions." [Corporate brand manager, repeated from Factor 1)]*

Rather than relying on consumer insights, Company A has more interest in the communities where they source the natural ingredients, and return the profit to.

> ***Company A****: "What is important is not the consumer but the community. We don't access to consumers. We access to the community (for local ingredients, social sustainability, etc.)." (Marketing manager)*

b) Balanced reliance on consumer insight

Case A and B showed opposite views towards consumer insight. Case A was almost against the use of consumer insight, whereas case B valued it more than anything as the core of the business.

Firstly, one of the interviewees from Company A was in extreme disbelief of consumer insight.

> ***Company A****: "The* ***innovation doesn't come from consumers****." (Marketing manager)*

In case of Company B, an explicit consumer prioritisation over sustainability practice was witnessed.

***Company B**: "We cannot give up other things for the sake of sustainability. It's all about adding sustainability to successful products. Sustainability must work as a charm enhancer." (Corporate sustainability manager)*

***Company B**: "One of the reasons why we started sustainability was to impress our consumers… successful design is what consumers accept. If the product sales fails, we cannot repeat it."(Brand manager)*

Some interviewees admit their fear of consumers.

***Company B**: "Korean consumers are very picky. The product development should consider their taste… because our customers hate it... If we ignore their voice… it could harm the sales and growth… Sometimes, we are forced and we must outrun the competitors… if we ignore them, the ripple effect is great to the company." (Sustainable growth director)*

c) Equal sustainability emphasis in brand portfolio

Varying levels were witnessed in the intensity of sustainability focus on different brands within companies. Both case A and B have a multi-brand strategy, and over 20 or 30 sub-brands exist in each company. Admittedly, neither of them had an equal sustainability emphasis in their brand portfolio. Some are stricter about sustainability, and others were less strict.

***Company A**: "As a mother corporate brand, we are very strong in sustainability. But some of the sub-brands have much lower connection to sustainability." (Eco design manager)*

***Company A**: "The process that formally guarantees that sustainability is in the business as a whole, not depending on the sub-brand. But how do we guarantee that in our fragrances or make-up? There is a process for sustainability but it's not totally integrated." (Corporate brand manager)*

***Company A**: "An element of sustainability is in each and every product. But some products push the boundary even further… some talk about it in a very bold way." (Strategic planning director)*

***Company B**: "Not every brand talks about sustainability. It's not much considered yet." (Project communication coordinator)*

***Company B**: "Some brands only require the minimum while some others have lots more to do with sustainability." (Sustainable growth director)*

***Company B**: "Such brands that focus on sustainability do the primary check-up, while others would do that either at the later stage or just ignore…" (Project communication coordinator)*

Company A and B shared a similar hope for the future. Even if they admit their limits in the sustainability performance of certain brands, they want to push others further to follow the best practice brand.

***Company A**: "XXX (The brand name cannot be named) is a very good example but … how can we see the whole portfolio clearly? There is a huge challenge in our glass products, premium products with sustainable design. It is an inspiring opportunity." (Corporate brand manager)*

***Company B**: "There are more sustainability-focused brands and less focused ones. We entitle the focused one as a Champion brand for each brand sectors from luxury, premium, mass, etc. We aim to monitoring these brands' sustainability performance, and let other brands to follow their precedents." (Design manager)*

Company B had more clear distinction between brands with high and low sustainability-focuses.

***Company B**: "XXX is the brand that does the most of the sustainability… We (sustainability department) give them 10% quota of sustainable products… Probably it will be very high for XXX brand, and will vary depending on brands.*

About 20% of our brand portfolio talks about sustainability." (Corporate sustainability manager)

***Company B**: "The development process for ordinary products and sustainable products are quite different." (Brand manager)*

***Company B**: "There are certain brands that are only focusing on large quantity or low price. Some other brands are for the luxury high-end market. And some other brands (sustainability focused brand) has to take the long Via Dolorosa, no matter how difficult and painful." (Design manager)*

d) Marketing dominance avoidance

In both companies, the very first stage of NPD: idea generation was exclusively marketing's own task. As described in Section 4.4.4: Cross-functional team, any other NPD developers do not partake in the first part.

In company B, marketers rank higher than other functions even if their position titles are same. Marketers have more decision power but often believe that sustainability undermines the product's profitability. Thus, the NPD process is prone to their influence.

***Company B**: "Brand managers could be as high as directors, and there is CMO (Chief Marketing Officer), who gets involved in many different brands. People are not the same level but marketing is slightly higher." (R&D researcher)*

***Company B:** "The decision is entirely up to the marketers." (Corporate sustainability manager)*

A lack of understanding in sustainability is overt among the marketers. Consequently, sustainability is often pushed behind the profitability within the NPD process.

***Company B**: "When the marketing stops us and says, '**Sustainable management doesn't matter to me**! I want the bottle looks more glamorous!',*

we cannot help but designing the bottles that way. Afterwards, designers feel guilty about doing something bad for the environment." (Design manager)

***Company B**: "Our marketers don't even know what LCA is. So we (corporate sustainability team) do the job and toss the sustainability target to them. Then the sustainability stuff doesn't look attractive to their eyes, so it becomes difficult to communicate with them… As yet, they see no value in using sustainability tools. (Corporate sustainability manager)*

e) Economy of scale flexibility

In case B, inflexibility in the economy of scale was witnessed. The size of their business was pointed out as an obstacle to implement sustainability practice. They believe the market is too small to make profit from sustainable products, even if they are the current market leader in South Korea.

***Company B**: "In fact, we try many different things. But it's unprofitable and economically unfeasible. In this sense, I envy U.S market very much. They are so big that the economy of scale is possible. But in many cases, Korean market is too small… So sales department often says 'Why do we do this? There is no profit!'" (Sustainable growth director)*

They see the production volume is too small to order a batch of sustainable materials.

***Company B:** "No matter how eager we are to pursue sustainable management, it is impossible unless the production volume of the brand keeps up. For example, if we want to use a recycled material, we shall produce 50 million products to use up the material, whilst we normally produce 10,000 products. It becomes a different league! So even if we know what's better for the environment, the **volume puts us off**. I guess a global brand would be able to use up such bulk material by distributing it to their sub-brands. But not in our case." (Design manager)*

f) Speed constraint flexibility

Undoubtedly, as the title of the sector (i.e. Fast-Moving-Consumer-Goods) suggests, speed is critical in the business environment of both cases. NPD process can take as short as five months up to one to two years.

> ***Company A**: "You have to think **very fast** in here. Not much time to think about many different things. That makes me tired." (Packaging development coordinator)*
>
> ***Company B:** "The pressure is high that we much be **quick**." (Project communication coordinator)*
>
> ***Company B:** "For some product range, speed and quantity are most critical. Such cases don't count a cross-functional teams whatsoever. Just speed! Some brands care the speed the most to catch up with the competitors. Sometimes they don't even need any ideas. They can come up with a new product within a few months… Our competitors are really fast, too. They come up with a copycat right away. (Eco design manager)*

Thus being flexible with the speed constraint is found to be critical. Otherwise the busy schedule can push sustainability consideration away.

Key elements of balanced focus on growth

- **Careful balance of Triple Bottom Line** is recommended.
- **Balanced reliance on consumer insight** is directly linked to the balanced focus on growth.
- **Equal sustainability emphasis in brand portfolio** is recommended.
- **Marketing** is required to **avoid** its **dominance** over other functions including sustainability.
- **Economy of scale flexibility** can lead the company to more balanced growth.
- **Speed constraint flexibility** can lead the company to more balanced growth.

4.3.11 Factor 11: Maturity of external contexts

Lastly, both Company A and B repeatedly asserted that the success is inevitably limited unless external contexts support. In other words, even if the companies address the aforementioned factors, potential barriers still exist that they need to cope with such as a) Consumer/ market maturity, and b) Infrastructural maturity.

a) Consumer/ market maturity

Company B showed fear in their target consumers' low sustainability understanding.

> ***Company B****: "However we want to practice sustainable management, without enough production quantity, it's impossible. We can expect the synergy effect, only when a brand with such philosophy has the matching production volume." (Design manager)*
>
> ***Company B:*** *"The level of interests in sustainability is lower in Korea compare to the developed countries… They don't particularly prefer the sustainable options… However hard we try, consumers don't acknowledge our effort in many cases... They* ***don't appreciate the eco-friendly*** *packages compare to the ordinary one." (Sustainable growth director)*
>
> ***Company B****: "Koreans love new stuff and hate anything old. Since we are a consumer goods company, it's difficult to incorporate anything consumers don't like.* ***Consumers don't have much knowledge about sustainability****." (Corporate sustainability manager)*
>
> ***Company B:*** *"We are still at the embryonic stage. We shall be persistent… Our consumers know that it's good. But they don't want to pay more for that. Price resistance is quite strong in Korea." (Project communication coordinator)*

When the target market or consumers are not mature enough in terms of recognising the benefits of sustainability, company's effort in sustainability can experience difficulties in convincing them to make purchase decisions in such products.

Although the leading companies are best to keep up with the firm belief and leadership in sustainability in the long-term view, understanding and supporting consumers and market keep company's economic sustainability healthy.

b) Infrastructural maturity

Both case A and B cases were suffered from the lack of a supply-chain support or government support. Case A did not have enough support in regard of material availability.

> ***Company A****: "Although we want to use recycled materials, we don't recycle in Brazil." (Packaging development coordinator)*
>
> ***Company B:*** *"This is not a job for one or two companies. The more companies participate and the more government pays attention, the better and more we can do together. Then more consumers will take part." (Sustainable growth director)*

Case B was discouraged by the lack of the external infrastructure to support their sustainability practice.

> ***Company B****: "In many cases… we cannot tackle the issues because of the lack of infrastructure. Korea is relatively weak in packaging. Recycling is done quite OK in Korea, but the recycled materials are often more expensive than the virgin ones. So internally it's not quite motivated. " (Sustainable growth director)*
>
> ***Company B****: "We reclaim 150 tonnes of used bottles, but there is no single company that can deal with them in Korea. There used to be one but not it's defunct… Without such infrastructure, we cannot possibly do anything with them. That's our challenge. Without a systematic support, what my company can do is very limited." (Sustainable growth director)*
>
> ***Company B****: "There are a number of issues that our factory cannot handle even if we want." (Brand manager)*

Key elements of maturity of external contexts

- **Consumer/ market maturity** can play as a roadblock.
- **Infrastructural maturity** can play as a roadblock.

4.4 Summary of In-Depth Case Studies Findings

Chapter 4 presents the analysed findings of the in-depth cases. This chapter is the analysis of the fieldwork that explored 14 questionnaires-based interviews within two market-leading FMCG companies in Brazil and South Korea. The findings are suggested in total 11 factors and 32 elements. Most of the factors directly confirm the literature through this study. The last two factors are derived from the consolidation of the analysis. Elements of each factor were extracted from the qualitative analysis of interview transcription.

It is identified that senior management support and strong sustainability vision are crucial to begin with. Firstly, in ***senior management support***, having a *firm sustainability leadership*, and *understanding of sustainability principles* are required. *Rewarding individuals for sustainability achievement* is also recommended. Secondly, ***sustainability vision*** has to be *aligned with company's general business vision* and the *dissemination through company philosophy and daily activities* is needed. Thirdly, ***internal communication*** is confirmed in this study. While *healthy inter-personal relationship* should be based, *various channels* are used within the company. Fourth, ***cross-functional team*** is another common factor that influences sustainable design and the front-end. The *involvement of company's sustainability officer into the NPD process* is a questionable aspect of cross-functional team, and an *equal level*

involvement of different functions was proposed. Fifth, supporting ***corporate culture of sustainability*** is identified as influential in aspects of six elements from *transparency, legacy, behaviour, belief*, and *structure* to *citizenship*. As well as the culture, ***individual attitudes*** of company employees are another salient issue. Three aspects such as *motivation* based on the past, *satisfaction* about the present, and *ambition* about the future compose the sixth factor. With respect to the operational side of sustainable design implementation, three factors are examined. The necessity of ***sustainability champion*** as an *official or voluntary* position is still debatable, which remained their *project level involvement* also in question. The eighth factor, ***sustainability tools*** usage is in dispute between two cases in this study. However, *customization of tools for company context* and their *timely introduction* are suggested as ideal. Ninth factor is ***clarity of sustainable design terminology***. Sharing an *agreed definition on sustainability terminology* among the company and consumers helps reduce confusion, and provides a *sense of sharing the same goal*. The tenth factor is ***balanced focus on growth*** that embraces six elements in relation to consumers and market. *Balanced reliance on consumer insight* is argued as one of the critical aspect while *careful balance of Triple Bottom Line* proposes the baseline for the business strategy. *Equal sustainability emphasis in brand portfolio*, and *marketing dominance avoidance* are another issues in respect that company should pay attention to along with *economy of scale flexibility*, and *speed constraint flexibility*. As the very nature of company is making profits, without a balanced focus on growth, sustainability can be slipped away fairly easily. Lastly, ***maturity of external contexts*** is suggested as an influencing factor and a possible roadblock. Not only of company's own accord, supporting external contexts such as *infrastructure maturity*, and *consumer/market maturity* can largely impact the sustainable design implementation in the NPD.

At the end of each factor, the perceived importance of each factor and their actual implication in practice are measured and presented in a quantitative manner. This is to demonstrate the disparity of each factors perception and practice a concretely at each company context.

The following chapter continues to verify the identified factors and elements in different FMCG contexts. Further interviews using a second set of standardised questionnaires were conducted based on the first findings of this chapter.

5. Result 2: Verification case studies

This chapter presents the outcomes of Phase 2: verification case studies. Three more FMCG case studies are undertaken to confirm and elaborate the factors and elements that have been highlighted in Chapter 4.

5.1 Introduction and Purpose

The purpose of Phase 2 is to verify the in-depth findings from Phase 1 in the previous chapter. The factors and the elements are confirmed and elaborated within three other FMCG companies. Three cases are chosen to represent a wider range of sustainability maturity levels (SML): mid-to-low. One of the biggest multi-national FMCG companies is included to provide a significant variety of cases in two aspects: 1) being a world-leading multi-national, and 2) the mid SML. See Section 3.6.2 for company C, D, and E introductions and their SML levels.

5.2 Sampling within each case company

A total of five questionnaire-based interviews were undertaken in three case companies. Each two sets in Company C and D, and one in case Company E (see Table 3.7 in Section 3.6.3).

Regarding two interviews at Company C, the senior design manager provided a straight forward answers and opinions about their sustainability practices in the everyday business environment, the other interviewee who had over 30 years experience as

research fellow provided the insight to the company's business structure and strategies. Both interviews took about an hour.

In case of Company D, a senior package designer and design innovation manager were interviewed. Although none of them has an official role about sustainability, both showed positive attitudes towards sustainable design at a personal level. Each interview took an hour.

The interview for Company E was with a package specialist at the company headquarters in the UK. Although it was only one interviewee, two company introduction presentations and an hour's company tour allowed an *in-situ* observation chance to gather additional information.

5.3 Assessment of Verification Data

This section describes the second findings derived from the verification of initial findings. 11 factors and 32 elements were suggested in the same format as the first findings. Due to the limited number of samples, the qualitative data was the main source of analysis, as descriptive statistics of five interviews hardly yield a meaningful analysis. Each section is presented with a data assessment table (Table 5.1-5.11) that indicates the dispositions of collected evidence across five cases including both phases. This leads to a holistic view to the overall tendency of case companies towards factors and elements.

5.3.1 Factor 1: Senior management support

Data from Phase 2 validates the importance of senior management support with negative data. Two case companies failed to provide positive evidence for the first two elements of senior management support and the other did not provide any evidence.

(see Table 5.1). For the last element, case C and E were negative while case D showed contrasting views in between two informants.

Table 5.1 Assessment of factors and elements of senior management support in case A to E[8]

FACTORS	ELEMENTS	IN-DEPTH		VERIFICATION		
		Case A	Case B	Case C	Case D	Case E
1. Senior Management support	a) Firm sustainability leadership	POSITIVE	NEUTRAL	NEGATIVE	NEGATIVE	N/A
	b) Understanding of sustainability principles	POSITIVE	NEUTRAL	NEGATIVE	NEGATIVE	N/A
	c) Rewarding the individuals with financial incentives	POSITIVE	POSITIVE	NEGATIVE	NEUTRAL	NEGATIVE

Detailed contestable quotes for each element are provided below.

a) Firm sustainability leadership

None of the cases for Phase 2 offered supporting evidence for firm sustainability leadership. Nevertheless, the general leadership in Case C appeared to be satisfying.

> ***Company C:*** *"In general, our leadership engagement is very clear and hands-on. Seniors actively get involved and provide lots of inputs. If I flag for help, they are willing to give you a hand. I am very happy with their leadership. It's very special for my company."*

Case D is an exemplar of weak sustainable leadership and a discouragement from a senior member was witnessed towards a bottom-up sustainable design attempt. For sake of cost saving, leadership wanted to continue business-as-usual.

> ***Company D:*** *"Once I've successfully run a bio plastic packaging project. But the company later capsized the project and said 'Just use the normal plastic.' The company was able to do it, but they didn't want to because it* ***needed a huge***

[8] Table 5.1 to 5.11 present the disposition of evidence collected from each company. 'Positive' means that the case company has evidence that supports the element; 'negative' means that the case company has evidence that stands against the element; 'neutral' means the case company has a range of both positive and negative evidence; and 'N/a' means the case company has no evidence regarding the element.

***investment with no clear profit**. They think '**Why do we have to**? What's the worth of the effort to change the production line when we can make money just like this?' The negative or closed attitude from the senior managers is our challenge. I heard there is no sufficient financial support. They say 'Don't spend too much even for the NPD!"*

Company E did not provide any evidence about this issue.

b) Understanding of sustainability principles

Case C and D generally revealed less understanding or favour toward sustainability in the senior management level.

Case C dis not talk about it.

> ***Company C: "**The top managers don't talk about sustainability. It's not their priority. They can't possibly take it unless there is any policy incentive. There must be a clear output such as governmental backup. It could a luxury for us as all the companies are on the tight budget these days."*

Case D did not have the awareness and cannot diagnose their sustainability deficiency.

> ***Company D:** "Internally, there is too little awareness of sustainability so we have difficulty in connecting it with growth."*

> ***Company D:** "Sustainability can never be solved from inside. External expertise has to be brought in to diagnose our sustainability problem. Insiders rather think 'what's wrong with us?'"*

In case of case E, there was no relevant data available.

c) Rewarding individuals for sustainability achievement

In respect of a rewarding system, two of the cases (C and E) did not agree on its necessity. The first informant from Case C was indifferent, and the second informant did not believe the necessity of having anything uniquely for sustainability.

> ***Company C:*** *"I don't know well. There are lots of ordinary prizes. It's not a huge financial reward but more like recognition… I don't know if we need anything about sustainability…"*

> ***Company C:*** *"There are incentives for individual contributions to NPD. Some of them will be sustainability NPD but not uniquely. Whether the products enter the market into the next stage, whether it's innovative, whether the management thinks it's a good idea. So it could be a good idea in the area of sustainability that will be rewarded. No Need for the financial incentives."*

Case D does not have one uniquely for sustainability however; sustainability can be part of the incentive criteria. Both informants showed their favour on such system.

> ***Company D****: "Yes, there is. When we write the sustainability report, they want to include something about sustainable design, materials or recycling. Because we have to! So if they acknowledge what I've done, they give an award. E.g. reducing the environmental cost, etc." "There are annual incentives but no incentive for sustainability specifically. There is a need for one though."*

Case E is an interesting example. As opposed to other two, they are so enthusiastic about sustainability that they do not see any need of special acknowledgement.

> ***Company E****: No. We don't need one. No, I think people have a high level of integrity."*

Overall, the above quote shows a slice of the apparent enthusiasm towards sustainability within the case E, as opposed to case C and D.

5.3.2 Factor 2: Sustainability vision

Phase 2 validates the Phase 1 findings with various evidence. Among two identified elements for sustainability vision, case C and D appeared negative while case E is positive for a) *alignment with company's general vision*. Case D keeps its negative view on the b) *dissemination throughout the company philosophy and daily practice*. On the other hand, case C and E turn out to be neutral about the element b). (see Table 5.2)

Table 5.2 Assessment of factors and elements of sustainability vision in case A to E

Factors	Elements	IN-DEPTH		VERIFICATION		
		Case A	Case B	Case C	Case D	Case E
2. Sustainability vision	a) Alignment with company's general vision	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	POSITIVE
	b) Dissemination throughout the company philosophy and daily activities	POSITIVE	NEUTRAL	NEUTRAL	NEGATIVE	NEUTRAL

a) Alignment with company's general vision

For both case C and D, it is clear that there are different sets of visions for company business and sustainability practice.

Case C's corporate vision, as stated in their official website, can be summarised as '*Providing high quality products and services that benefit consumers' lives, so that we will continue thriving*.[9]' (the purpose of the corporate, available on the corporate website[10]). Noticeably, it appears to have borrowed some expressions from the definition of 'sustainable development by Bruntland report (1987)'. However, the interview revealed a strong denial of any grain of sustainability in it.

> ***Company C:*** *"No, it only means **we sell more** and more **now** and in the **future**. It's **all about consumers buying more** our products and shareholders paying for our stocks."*

[9] Paraphrased for confidentiality
[10] Last visited on 25th May, 2014

According to the above quote, their general vision is quite distant from their sustainability vision, which includes renewable energy and zero waste (CSR report, 2013).

In case of company D, according to their CSR report (2012), the corporate vision includes health, beauty and refresh, but excludes any concept of sustainability; while the CSR vision reads to become '*the best sustainable FMCG*'.

> ***Company D****: "Our company vision? Obviously, it will be 'a company that provides health and beauty to customers from customer's perspective."*

The informants agreed on the importance of having sustainability vision, still admits the full alignment is not possible for them.

> ***Company D****: "A sustainability vision is so difficult… if there was one, it would be 'a company that contribute to the society?... I believe having a sustainability vision is important... If we don't pay attention to such a thing, our customers will view us as only a profit-driven company."*

> ***Company D:*** *"A company like Method tries to be environmentally-friendly at the company level. We are not like them…"*

Whilst, the informant from case E was able to enunciate their purpose[11], regarding sustainability.

> ***Company E: "****Our vision is to become the Europe's favorite little juice company. One of the reasons to be 'favourite', partially because we taste good and partially because we do good. So being favourite indirectly has sustainability in it… Obviously it's not many words but it's quite a big statement. We all have different visions in our departments and we have company vision. We have the supply chain vision. And that has sustainability in it. It's a good inspiration but it's not the only thing."*

[11] Interpreted as a vision in this study

Case E does not have a separate sustainability vision, instead, their company values embrace sustainability elements, including nature, responsibility, and generosity[12]. Thus is case E is considered to have aligned their sustainability vision with their general corporate vision.

b) Dissemination throughout the company philosophy and daily activities

Case C and E have contrasting evidence on element b), whereas D showed negative. Let alone the alignment, both informants in case C revealed a detachment in the subject matter.

> ***Company C****: "There is (sustainability vision in our company). I don't know what it is."*

> ***Company C: "****No* ***I don't know*** *what our sustainability vision is. You can look up. There must be online…"*

However, ironically, case C administered a set of sustainability rules in their NPD, and applied them well within the company.

> ***Company C:*** *"Very early every project will be judged against some sustainability target. If it doesn't meet the target, it will be dropped. We have a sustainability strategy… It's pretty effective because you kill the project otherwise. This overarching strategy is well communicated in the system."*

Yet, the same informant (a former R&D director) failed to articulate its details. This brings the question about its dissemination of concrete contents.

> ***Company C:*** *"…I don't know what it is. There is one… read it in the sustainability report.* ***But it never reaches the troops****. OK?"*

Case D was frankly admitted the absence of sustainability practice in their company.

[12] Company website last visited on 25th May 2014

> ***Company D:*** *"We hardly have anything like this… there is no such concept like sustainability in our company."*
>
> ***Company D:*** *"To be honest, if you have to take account of sustainable management, it's too difficult to design. How creative or shocking the design is most important, not how sustainable it is.* ***We never think of sustainability seriously****… We talk about sustainable design in our informal brainstorming session but we rather separate ideals and reality. We don't do talk about it seriously as we do about like profitability or feasibility."*
>
> ***Company D:*** *"We rarely talk about it. Let's not say 'never', but* ***'rarely'****… realistically it wasn't compatible with cost or time… Recently, I've read an article in which my company won an award for sustainability. Maybe we are doing something that I don't know. I have no idea."*

The only informant from case E mentioned that they want to expand their sustainability strategy.

> ***Company E:*** *"We are just in the middle of making our strategy bigger in the company, and making it easier for people to talk about the sustainability impact at the very beginning."*

Although the above does not contain strong evidence, additional *in-situ* observation and the documents reveal the presence of daily sustainability practice. For example, the company consistently run campaigns to protect bees, forests, and charity events to support the elderly people.

5.3.3 Factor 3: Internal communication

Phase 2 data adds more details to the Phase 1 findings with positive evidence. Internal communication is the one and only where all the verification cases (C, D and E) showed positive evidence in both elements a) and b). (See Table 5.3)

Table 5.3 Assessment of factors and elements of internal communication in case A to E

Factors	Elements	IN-DEPTH		VERIFICATION		
		Case A	Case B	Case C	Case D	Case E
3. Internal communication	a) Healthy inter-personal relationships	POSITIVE	NEUTRAL	POSITIVE	POSITIVE	POSITIVE
	b) Variety of channels	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE

a) Healthy inter-personal relationships

All three case companies showed their satisfaction in their internal communication. The informants were happy with their internal communication in general. One informant from case C gave a full score in communication among juniors and seniors. And the other informant agreed about the easiness of vertical communication.

> ***Company C: "****It's pretty fluid. Once I want to communicate with them, it's easy."*

In case D, the overall verdict is positive, especially about the horizontal communication.

> ***Company D:*** *"The horizontal communication is quite good in my design centre. We are quite open-minded. Although the seniors are old in their ages, they don't look down the younger ones. They are good people. It's a good point in my company."*

As originated and located in the Far Eastern Asia, where the youngers are traditionally expected to respect and obedient to the elders, a cultural influence has to be taken into account in terms of vertical communication.

> ***Company D:*** *"We need to consider what the company wants, and what the CEO wants… we need to think of many relationships. It's characteristic in Korea. Will the senior think it as fresh? The communication with the senior is entirely up to the individuals. But in general, it's quite OK."*

> ***Company D****: "Compared to other Korean companies, the vertical communication is quite fluent here."*

The informant from case E is quite happy about the vertical communication scoring 4 out of 5, although there is a usual difficulty to get in touch with the seniors due to their busy daily life.

> ***Company E**: "It's difficult to get a forum with people who are very senior because they are very busy. Sometimes you have to wait for a month to speak to them. Hierarchical difficulty? I wouldn't go directly to the CEO but I will always follow the hierarchy and go to the right channel. You always know who to talk to."*

c) Variety of channels

All three appeared to utilise multiple means of communication with satisfaction both formally and informally.

> ***Company C:** "We have loads. The email responses are quick and we have weekly meeting, monthly meeting… We can also ask for 'one-to-one request' and lots more**."***

> ***Company C**: "Meetings, weekly report reviews, email, and everything."*

> ***Company D**: "Formal meetings, everyday conversations, emails, text messages, it varies. It's quite easy to communicate."*

> ***Company E**: "The decisions are made at the monthly meeting with all the seniors. But the communication channel will be through your line manager. And informal communication, meetings, probably more emails than everything else."*

The communication includes a) formal: (weekly, monthly) meetings, reports, and b) informal: Emails, text messaging, conversations, and one-to-one request.

5.3.4 Factor 4: Cross-functional team

Three cases from Phase 2 confirm the initial findings with various evidence. The cross-functionality of the NPD team turned out to be poor in the element a) and b) while case C and E were positive in b). (See Table 5.4)

Table 5.4 Assessment of factors and elements of cross-functional team in case A to E

Factors	Components	IN-DEPTH		VERIFICATION		
		Case A	Case B	Case C	Case D	Case E
4. Cross-functional team	a) S. officer involvement	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
	b) Equal level engagement	NEGATIVE	POSITIVE	NEUTRAL	NEGATIVE	POSITIVE

a) Sustainability officer involvement

None of the cases indicated the involvement of sustainability officer at the project level. In case C, the existence of such position is denied.

> ***Company C:*** *"As far as I know, we don't have such person (sustainability officer)."*

According to the below quote of case D, such a person does exist but neither is known to the general company employees nor engage in the NPD process.

> ***Company D****: "There is a sustainable management team in the company. But I have no idea what they do. I am sure that 99% of us don't even know about this person (sustainability officer)'s existence… They never come to the NPD. They directly belong to the vice president and in charge of corporate image making. They create the advertisement for shareholders and future plans. 99% of wouldn't even know if we have such team in this company."*

For case E, the situation is not different.

> ***Company E:*** *Sustainability manager? They do* ***not come in at all*** *in the early stage. That person nominates who represents sustainability from every department."*

As opposed to author's initial assumption prior to the data collection, sustainability officer appears not to get involved directly in the NPD project.

b) Equal level engagement at Stage 0

For case C, cross-functionality is fully emphasised at the corporate level, and practiced from the front-end of NPD (i.e. Stage 0-3: idea generation, business scoping and project specification), which is seemingly ideal.

> ***Company C:*** *"It's very important to function as a cross-functional team… The company is saying that everything has to be driven by the multi-functional team."*

> ***Company C:*** *"Usually we write the new project brief all together: design, marketing, R&D, packaging development, product supply."*

However, interestingly, both informants in case C complained about their excessive cross-functionality, for too many voices hinder the progress of a project, resulting the effectiveness to score only 2-3 out of 5.

> ***Company C:*** *"… as soon as you get more people involved, they bring an opinion too early… R&D includes marketing, finance, manufacturing, and technology (that) includes sustainability.* ***But what do they know?"***

> ***Company C:*** *"We are rather* ***too*** *much multi-functional to control the process. Too many departments are involved and no specific one takes the lead. Sometimes everyone wants to take the lead and make it difficult to move on. It's ironic!"*

Inversely, case D complained about a lack of cross-functionality in their NPD projects. Designers are not included until the rear-end of the process (i.e. Stage 4-6: development/ prototyping, test and launch), but the marketer and sales department take part in the front-end.

> ***Company D:*** *"NO, NO, NO, NEVER! Designer never goes in the Stage 0… it's not important here."*

> ***Company D:*** *"Usually designers don't go in the first stages. Sometime the factory requests us to join the front-end. It's too far away! As I understand, the marketer, R&D, and sales team write the initial brief. It's mainly the marketer's job. Once they come up with the product concept, then designers begin to join. Marketers give the reference point along with the product concept. Then designers start working on it."*

On the other hand, case E revealed a good level of cross-functionality with a high level of satisfaction.

> ***Company E:*** *"It's very important, for sustainability particularly. When we have a big new product development projects, we have the system that everyone comes together, that's great."*

5.3.5 Factor 5: Supportive corporate culture

In terms of supportive corporate culture, Phase 2 verifies the Phase 1 findings. Case E showed positive evidence in all six elements, whereas case D was positive in a) only, case C showed a mixed evidence across the elements. (See Table 5.5)

Table 5.5 Assessment of factors and elements of supportive corporate culture in case A to E

Factors	Components	IN-DEPTH		VERIFICATION		
		Case A	Case B	Case C	Case D	Case E
5. Supportive corporate culture	a) Transparency	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE
	b) Legacy	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	POSITIVE
	c) Behaviour	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	POSITIVE
	d) Belief	POSITIVE	NEUTRAL	NEGATIVE	NEGATIVE	POSITIVE
	e) Structure	POSITIVE	NEUTRAL	POSITIVE	NEGATIVE	POSITIVE
	f) Citizenship	POSITIVE	POSITIVE	NEUTRAL	NEUTRAL	POSITIVE

a) Transparency

Transparency in sustainability is one of the rare elements all cases were positive. This element includes disclosure of information on the manufacturing processes, materials sources, and business practices, and financial administration.

> ***Company C:*** *"It's very important because it clearly identifies that we are committed."*
>
> ***Company D****: "My company doesn't tell lies or hide anything. We put a high value on fidelity."*
>
> ***Company D: "****We pay very special attention and keep everything crystal clear… Despite not directly related to sustainability, the company says we cannot neglect the waste. It will harm the company image."*
>
> ***Company E:*** *"It's quite a* ***big part of our brand****."*

Above quotes from case C, D and E exhibit the importance of transparency in supportive sustainability corporate culture.

b) Legacy

Legacy in supportive sustainability corporate culture (defined in Section 4.4.5 b) had negative evidence in case C and D, and positive in case E.

An informant from case C provided a puzzling sort of answer as below.

> ***Company C: "****my view is that our sustainability legacy* ***mirrors the population****."*

The author of this research interpreted the above answer as minor/ negative, as their sustainability report repeatedly claims that the majority of consumers are unwilling to accept sustainability over the price or performance (sustainability report 2012). Also, the other informant frankly admitted the absence of such culture in their company.

> ***Company C:*** *"No, there is* ***no culture*** *of sustainability here."*

For case D, both informants score the importance of legacy quite high: 4 out of 5, however a lack of understanding appeared.

> ***Company D:*** *"I don't know. Is it about product manufacturing?"*

In case E, albeit the company history is the shortest among all cases: they started in late 1990s, the legacy for sustainability is noticeable.

> ***Company E: "****That's huge one."*

The founders began the company with a strong sense of responsibility for the environment and society. For example, 10% of profit has been going to the charity each year and sustainable legacy explicitly appears in the introduction section within the company website[13].

[13] According to the corporate website, last visited 25th May 2014.

c) Behaviour

In this research, behaviour of sustainability refers to the commitment of the company / employees daily practices.

The informant of case C was honest enough to express their aloofness of sustainability in the daily activities.

> ***Company C: "*** *I don't think people will have sustainability at the front of their mind in their day."*

Case D admitted the importance of it, while not implemented in the daily practice.

> ***Company D: "Generally*** *we believe it's important. But it's easier said than done… We try. But carrying the belief into practice is difficult."*
>
> ***Company D:*** *"We rather try to embed it to the company image than products."*

From the *in-situ* observation at the headquarters, Case E shows a range of sustainable behaviour evidence at the organisational level. For example, commuting by cycle was encouraged, and shower facilities were available for all cycling employees. And employees' health was also being taken care of through the free provision of healthy breakfast at the communal kitchen by the company.

d) Belief

Along with behavior and norm, belief is one of the key components of corporate culture (Deshpandé and Webster, 1989).

The same informant from case C gave the same ambiguous answer to a question about the belief in sustainability for the second time. Thus this quote is considered negative according to the interpretation in the above Section 5.4.5.b.

> ***Company C: "****As I said earlier, it* ***mirrors the population****."*

Case D also doesn't believe in success of sustainable design.

Company D: *"Designers talk about it informally, but in the actually NPD project, we fundamentally believe that this kind design cannot be successful."*

Case E has an over-riding principle by which they make all decisions so-called '*the nursing home test'*. They believe in creating a business they can be proud of to their grandchildren in the future.

***Company E: "Operating our business sustainably is very important**."*

A positive attitude toward sustainable design was witnessed.

***Company E**: "Sustainable design is often seen as a limitation but it can be seen as an **opportunity**."*

e) Structure

Case C and E are positive about their structured system for sustainability practice within the companies.

***Company C**: "Yes, for sure. It's very very [sic] structured. You've got a clear management structure. It's more to the point that the management reports sustainability directly to the CEO. There is the vice president of sustainability. It's a big deal."*

Case D was negative about their structure for sustainability. A denial or ignorance for sustainability practice was captured.

Company D: *"No way!* ***No structure*** *at all!!! We are completely random. We sometimes do it, sometimes don't. In a nutshell, no structure at all!"*

Company D: *"I really don't know about this. There is no structure at all within my design centre."*

On the other hand, case E is confident in its strong structure for sustainability practice.

Company E: *"We have* ***a very defined project management process*** *here and pretty much every project is following it. We always have a great process… It's pretty well structured. We've got teams, champions, and it's all within our vision."*

f) Citizenship

In this research, citizenship for sustainability means to set an example to the society and other businesses. Case C and D appeared to be neutral in this element, unlike case E's positive attitude.

As stated in an external citizenship report (Economist, 2008), case company C's present sustainability director clearly acknowledged the importance of getting a corporate citizenship.

Company C: "*It should become part of the core values of the company, not an add-on run by a corporate-relations group."*

However, the empirical data provided a short answer without any further confirmation.

Company C: " *I think people recognize it."*

In case D, the informant agreed on its presence of the general citizenship, which is rather based on leading the market by sales, not explicitly by sustainability practice.

Company D: *"Yes, we are aware of it but not in practice yet… We often talk about leading the market. But that's more through sales and new product introduction, not through sustainability."*

Case E has an explicit approach to sustainability stating;

Company E*: 'Leaving things a little bit better than we find them."*

The five main impact areas include nutrition, ingredients, production, packaging and legacy and all of them consider the influence to the society. They care what they offer

to consumers, how they source the ingredients from farmers, how they produce and deliver the products and what they contribute to the world.

5.3.6 Factor 6: Individual attitude[14]

The Phase 2 cases confirm the Phase 1 outcomes with various evidence. The Individual employees' committed attitudes towards company's sustainability practice in a) motivation upon past, b) present satisfaction, and c) future ambition were mixed in case C and D, and all positive in case E. (See Table 5.6)

Table 5.6 Assessment of factors and elements of individual attitude in case A to E

Factors	Components	IN-DEPTH		VERIFICATION		
		Case A	Case B	Case C	Case D	Case E
6. Individual attitude	a) Motivation based on company's past sustainability practice	POSITIVE	NEGATIVE	NEGATIVE	POSITIVE	POSITIVE
	b) Satisfaction about company's present sustainability practice	POSITIVE	NEUTRAL	NEUTRAL	NEGATIVE	POSITIVE
	c) Ambition about company's future sustainability practice	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	POSITIVE

a) Motivation based on company's past sustainability practice

In case of company C, both informants reported a lack of personal motivation. The question of personal importance of sustainable design rated lower than neutral (2 and 2.5 respectively out of 5). For one, sustainability does not have any influence on the decision.

> ***Company C:*** *"I never make decisions based on sustainability. I can say* ***it's not important****. I cannot say it's never important, but it's not."*

[14] The author admits that, by the nature of the subject matter and a limited number of informants from each company, a certain degree of informant bias was unavoidable. The details of how this is addressed are further discussed in Section 7.3.

The other one also expressed the similar.

> ***Company C: "****I don't know much about it. Maybe because I am* ***not*** *personally too* ***passionate*** *about it…"*

In case of D, below quote make it possible to assume that the personal level of motivation is high.

> ***Company D:*** *"I personally believe in its importance. All designers should take account of sustainability. "*

The informant from case E was affirmative about its positive attitude toward sustainability.

> ***Company E: "Sustainability is the standard."***

b) Satisfaction about company's present sustainability practice

In terms of the satisfaction, the informants from case C rated from neutral to high (3 and 4 out of 5). However these answers are contradictory to both the company SML and the previous answers given by the participants.

For case D, the satisfaction rate appeared disparate between two informants: one was never (1 out of 5), and the other one is high (4 out of 5), while the interview exposed levels of frustration towards the market success of sustainable design. Unlike those from case C, the informants from case D were keen on sustainability and application of sustainable design, their bottom-up approach did not get through to the top or the market.

> ***Company D:*** *"Sustainable design is difficult to be attractive in the shape or materials. Also I am* ***always suspicious*** *if the consumers would want it."*

> ***Company D:*** *"For me personally, I* ***am not happy at all.*** *I never reached my own goal in sustainability here. I* ***wished*** *I could design the package that doesn't make consumers feel guilty. But I* ***failed****. It didn't apply to my company or the*

society. It's also difficult for consumers to choose… At home I try to do my bits like recycling, saving water, donating my old clothes and all."

For case E, the informant gave its personal satisfaction a full mark without hesitation (5 out of 5).

***Company E:** "Individual attitude? FIVE!!! **Satisfaction? FIVE!!**"*

Also, the general satisfaction level within the company was addressed in case E.

***Company E: "** People are proud to be a part of the company."*

According company presentation, a research in 2011 showed that 95% of employees were proud to work for case E.

c) Ambition about company's future sustainability practice

Both informants in case C did not give any positive evidence towards their future expectation of sustainability practice. Firstly, one expressed no priority to sustainability.

***Company C:** "Own sustainability goal? **NO.** If I want to get a sport car and cannot get it with sustainability, then I will choose one without it."*

The other informant was personally negative and also suggested that this was a view that was common across the whole FMCG industry.

Company C:** "If you ask any consumer-goods company, **I bet NONE** of them can give you any positive answer. It's just a pure luxury if you want to do everything sustainably. **I cannot even see any** advantage in doing so… Without any clear benefit within 1-2 years, no company will want to do it unless **they are mad. No** they **MUST NOT** do it. There is no tangible outcome**!"

The same informant perceived sustainability only as a marketing tool.

***Company C: "**Maybe as a **marketing tool**, we just can say we are sustainable?"*

Whilst casting a distant view on the future direction of their sales strategy towards sustainability.

For case D, although both informants were certain about their own sustainability goals at the personal level, the perspective of their company's future sustainability practice was pessimistic.

> ***Company D:*** *"To be honest, it's very unlikely for sustainable design to become a major project. I just pursue it at my personal level."*

In case E, the informant was the enthusiast within the company.

> ***Company E:*** ***"****I was the one who says; 'Hey, have you thought about this sustainable aspect?' I want to make things sustainable. I want to leave the world better than I found it. I do want to have a positive impact on the world."*

5.3.7 Factor 7: Sustainability champion

Phase 2 data confirms the Phase 1 findings. The confusion about sustainability champion from Section 4.4.7 is continuously witnessed in this phase. Sustainability champion received mixed responses across the cases. (See Table 5.7) Case C did not believe in its necessity hence was negative about all the elements. While case D and E gave a mixed set of evidence about its official position and involvement.

Table 5.7 Assessment of factors and elements of sustainability champion in case A to E

Factors	Components	IN-DEPTH		VERIFICATION		
		Case A	Case B	Case C	Case D	Case E
7. Sustainability champion	a) Project level involvement	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	POSITIVE
	b) Official vs. voluntary	NEUTRAL	NEUTRAL	NEGATIVE	NEUTRAL	NEUTRAL

a) Project level involvement

Both case C and D denied its existence, instead the informants provided a glimpse of a similar job within the company.

However, the job in case C described below had a different job (i.e. decision making at the Gates) than a typical champion's job as a project helper / information point.

> ***Company C:*** *"But there will be an advisor; they are in R&D… They have to attach themselves to the projects and they sign off on projects. They have a vice president, directors, first line manager."*

Case D showed a similar phenomenon to C. They had a legal compliance team who confirms the product's legitimacy at the end the NPD process, rather than gives advice during the process.

> ***Company D:*** *"We have packaging development team, where they check the packaging regulations. But it's only for the legal compliance. Currently, we just randomly launch products."*

Thus, the above two cases are difficult to be considered as having a proper champion.

In case E, the concept and structure for such a person was clearly systemised. The company has officially assigned a head of sustainability, who provides an overall direction to champions. Then the champions get involved in the process with the given direction.

> ***Company E:*** *"We have one* ***head of sustainability****… she talks to us (champions) and we disseminate the knowledge."*

b) Official vs. voluntary

Case C did not have sustainability champion either at official or voluntary level. Also its necessity was denied.

> *Company C:* ***"****No****, we don't have one****. We don't need one."*

Case D also denied its presence as well as its importance in either level.

> ***Company D: "No,*** *there is no one like that. For my company, it's not very important. I believe it's better to train everyone to bring sustainability in their everyday job than singling out someone to do it."*

Reversely, the informant in case E firmly believed its importance and claimed themself as the voluntary champions.

> ***Company E: "I was the one who*** *says 'Hey, have you thought about this sustainable aspect?' It's always important because it's a way of disseminating sustainability throughout the business." (repeated from Factor 6)*

Addressing the controversy of sustainability champion, no case turned out to have an official function as ideal as the academic description (see Section 2.7.7) in this research. In lieu, the more mature case companies (e.g. case A and E) appear to have the voluntary champions within the process. Apart from the voluntary position, all the cases had the official sustainability team at the corporate level.

5.3.8 Factor 8: Sustainability tools

Phase 2 of this study adds more details to the Phase 1 findings. A polarised stance was observed towards tools between case C, D and E. Whilst the concept of sustainability tools was perceived as controversial, this verification stage provides more evidence that supports its benefits for better practice. High SML cases such as Company A and E use sustainability tools actively, whilst mid-to-low cases such as Company B, C and D rarely acknowledge or use tools.

Case C and D were consistently either n/a or negative whilst case E was positive about both elements. (See Table 5.8)

Table 5.8 Assessment of factors and elements of sustainability tools in case A to E

Factors	Components	IN-DEPTH		VERIFICATION		
		Case A	Case B	Case C	Case D	Case E
8. Sustainability tools	a) Customisation for company context	POSITIVE	POSITIVE	N/A	N/A	POSITIVE
	b) Timely introduction	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	POSITIVE

For case C, first of all, both informants acknowledged neither utilisation nor necessity.

> ***Company C: "****No, we don't use tools. Not really [sic] I feel that we need it."*

> ***Company C:*** *"No. Maybe they do but I've never done this... Not really [sic] need any additional aid for making decisions, tools..."*

Company D, too did not use any tools.

> ***Company D****: "Maybe… it will be good to have one. If not, well that's fine… We never use it. What is LCA? No we don't use it. I don't know what the concept is. There are legal regulations about excessive packaging, no toxic fumes during incineration, etc."*

Even though the perception was poor, both informants did not as disapprove tools future benefit as case C.

> ***Company D:*** *"It could be helpful to understand."*

Unlike above two cases, case E showed its keen interest and favour in tools.

> ***Company E: "****Yes, we use it, I think tools are great."*

a) Customisation for company context

For case C and D, no evidence for element a) was available as both negated the use of tools in their NPD process.

On the contrary, case E agreed on its benefit and on the verge of developing one for its own context and needs.

> ***Company E:*** *"I'm trying to develop more sustainability tools that are easy. We've identified that we wanted to develop our own we don't have it currently. We've tried in the past but it was too bloody complicated. We already reckon it's brilliant. It's* ***really good."***

b) Timely introduction

The timing of introducing tools appeared to be important during Phase 1 case studies (see Section 4.5.8).

Besides not currently using the tools, case C again was negative about its adoption during the front-end of NPD.

> ***Company C:*** *"If people have to use these tools all the time to assess at each stage, you* ***will be forever*** *using these tools and never moving on."*

In case D, although not currently using, the potential benefit of adoption was agreed at the rear-end.

> ***Company D:*** *"It will be nice to have experts who will check before launching so that you know what the impact of the products will be."*

Case E expressed the difficulty of adopting it to the front-end.

> ***Company E****: "I don't use it right at the beginning. Cause it needs quite a lot of effort to put into it."*

To summarise, despite the utilisation and the introduction timing variation, the higher the company's SML is, the more benefit of using tools were recognised.

5.3.9 Factor 9: Clarity of sustainable design terminology

Phase 2 adds more details to the Phase 1 findings. In Phase 1 (see Section 4.5.9), case A and B revealed a confused view about agreed terminologies and definitions. Table 5.9 reveals an interesting pattern between the in-depth cases and verification cases. While both in-depth cases had varied evidence which is neither positive nor negative about clear terminology, case C showed all negative evidence for both elements, case D were positive about one and negative about the other, and case E was all positive.

Table 5.9 Assessment of factors and elements of clarity of sustainable design terminology in case A to E

Factors	Elements	IN-DEPTH		VERIFICATION		
		Case A	**Case B**	**Case C**	**Case D**	**Case E**
9. Clarity of sustainable design terminology	a) Agreed definition on sustainability terminology	NEUTRAL	NEUTRAL	NEGATIVE	NEGATIVE	POSITIVE
	b) Sense of sharing the same goal	NEUTRAL	NEUTRAL	NEGATIVE	POSITIVE	POSITIVE

a) Agreed definition on sustainability terminology

To begin with, one of the informants from case C challenged the fundamental question for this section: the use of such terminology, let alone the importance of the agreed one.

Despite the function as a senior design manager, this person denied the use of any of the related terminology, arguing their consumers prefer organic or natural to green, eco, and sustainable design.

> ***Company C:*** *"We don't use any of them at all. Instead we use organic or natural because consumers find it like a Hippie if we use 'green' or 'eco'. When they buy shampoo for its organic or natural ingredients not eco design."*

> ***Company C:*** *"I don't really feel the need a lot."*

The other informant, who is the former R&D director and present strategy advisor, admitted the existence of a set of their own definitions for relating terminology, without having concrete knowledge of the contents.

> ***Company C*** *"Yes, there is a message track about terminology, but* ***I don't know.*** *Importance?* ***Never."***

Over all, both rated the importance of having an agreed on low or neutral (2 and 3 out of 5).

In terms of uncommon usage of such terminology, a similar view was recorded in case D (senior package designer) as below.

> ***Company D:*** *"There is hardly anything like this in my company… Is organic eco-friendly? We use natural or –free more often. There is not much about sustainability… What's the difference between green and eco?"*

Meanwhile, the other informant from case D expressed that they use different terminologies in a mixed fashion within the company as well as with consumers.

> ***Company D:*** *"We all use them differently. I use sustainable design. Green design? Never. Eco is now obsolete. We use environmentally-friendly the most. It's easy to understand for Koreans. Sustainability sounds like economics. But there is no agreed one."*

In contrast with the non-existence or the unconsolidated use of different terms in case C or D respectively, case E appeared to be certain about use of sustainable design. Nevertheless an official agreement was not claimed.

> *Company E****: "Sustainable design,*** *always. No agreed word to use. But we use sustainable design."*

b) Sense of sharing the same goal

Despite the disapproval of the usage or necessity, one believed its potential benefit in case C and the below quote supports the element b).

> ***Company C:*** *"…it could be useful for personal communication?"*

Similar to the response pattern to sustainability tools, case D claimed the importance of the subject matter even though it was not currently practised.

> ***Company D:*** *"I guess we really need it. Sustainability is too difficult. I feel there is a need for an agreed one to share."*

> ***Company D:*** *"It will be important. When I talk about it, even though you cannot change the whole company, I could still influence one or two. Sharing the same concept will be good for understanding."*

Both informants from case D advocated the potential benefit of using clear terminology in helping sharing the same goal.

Although no tangible data was collected from the interview, Case E is consistent in using 'sustainability' in the company philosophy according to the company website[15] and presentations.

5.3.10 Factor 10: Balanced focus on Growth

Data from Phase 2 validates some of the initial findings. This section looks into six elements[16] in order to check the case company's ultimate goals and the balance of them. Table 5.10 revealed a considerable contrast between case A and B, and a similar pattern is recurring between case C, D and E.

[15] Last visited on 27th May 2014.
[16] Detailed rationale for elements is discussed in Section 4.5.10.

Table 5.10 Assessment of factors and elements of balanced focus on growth in case A to E

Factors	Elements	IN-DEPTH		VERIFICATION		
		Case A	Case B	Case C	Case D	Case E
10. Balanced focus on Growth	a) Careful balance of Triple Bottom Line	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	POSITIVE
	b) Balanced reliance on consumer insight	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	POSITIVE
	c) Equal sustainability emphasis in brand portfolio	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE	N/A
	d) Marketing dominance avoidance	NEGATIVE	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE
	e) Economy of scale flexibility	N/A	NEGATIVE	NEGATIVE	NEGATIVE	N/A
	f) Speed constraint flexibility	N/A	NEGATIVE	NEGATIVE	NEGATIVE	N/A

Below quote from case C exposed their priority on profitability over sustainability.

> ***Company C:*** *"As far as I know, we don't give much focus on recycling or eco-friendly. We rather focus on profitability or cost… It's difficult for us to pursue it without any tangible direct profit-driven output. Sustainability is such an intangible concept. Even if we make a huge investment, we may have the output in the next year, or it could be just conceptual… For example, if we can see any implication by using soya ink, for example if it reduces the production cost, naturally we will adopt it. But it's also about changing our present production system and infrastructure, which could imply cost increase. It's all related! If we were like Loccitane and it's our equity, we will do so. But for us, it's not so big."*

a) Careful balance of Triple Bottom Line

Case C revealed that they focus on a number of issues that are directly linked to the profitability from growth, cost, to consumers. But not much evidence on the pursuit of balance of environment or society.

> ***Company C: "****Is* ***growth*** *important? No brainer! Cost implication is big here. We need to produce lots of products at a* ***low cost****."*

> ***Company C: "Consumer expectation*** *and business* ***growth*** *strategy are the fundamental drivers for NPD… Growth provides returns and investments. It's the nature of business. One of the implication of the growth that is you become the market leader and you can control the market through pricing, product development, and advertising."*

Case D also prioritised growth, and sustainability was treated as an add-on or a marketing medium.

> ***Company D: "Growth*** *is really important… Sustainability doesn't really affect our growth****.*** *That's why there is no action or a department. In my opinion, it's nice if we are good at it, but even if not, it doesn't harm the company image too much. It's like a* ***supplement****."*

> ***Company D "****My company constantly responds to the market trend… Actually sustainability is a part of marketing, isn't it? If it's 50% success rate in the market, it's* ***difficult to risk the failure."***

Case E made it clear that they also pursued growth in size and acknowledged compromises between business growth and sustainability. However the majority of Case E answers indicate that the most sustainability option is always strived for, whilst making business sense.

> ***Company E: "****We want to be bigger. We want to be Europe's favourite… Sustainability doesn't hinder the progress. But it's not always listened to. It*

doesn't always get acted upon. Decision doesn't always go that way… They are weighing up the business benefits vs. sustainability comes in."

Case E addressed the justification they make through offsetting the impact of a product with that of another.

> ***Company E: "****We know it's bad for the environment but great for the business benefit, we have to justify it. So for that example, we know it's not good for the environment as could be but we think the other things we do will* ***offset*** *that."*

b) Balanced reliance on consumer insight

For case C, consumer insight has been always the first priority and it is repeatedly emphasised in the below quotes.

> ***Company C: "****What is most important for us is listening to consumer insight and providing products at a good price****…*** *If sustainability means the balance of those three, it's not really balanced here. Everything we do is basically with* ***'Consumer is king'.*** *It's how this company is made. Innovation through consumer insights is our vision. We believe everything comes from consumers."*

> ***Company C:*** *"We have five core components: consumer, branding, innovation, go to market, and scale, so that we can expand broadly and quickly… It was consumer-driven."*

Case D is not very different from C. No evidence on other issues was found.

> ***Company D:*** *"We are* ***100% consumer-oriented.*** *The company vision is to get closer to the customers through customer insights and make what they really want… consumer focus is so important every time we develop new products!"*

A different approach for case E was, meanwhile consumer focus is still emphasized, the potential influence to sustainability was recognized.

> ***Company E:*** ***"****Consumer focus at the early stage of NPD is* ***vital****. But for sustainability, if you think of* ***consumers too much, sustainability could die****, absolutely… We only do the* ***sustainable things that we think consumer wants it."***

The company presentation document (2011) included the cautionary lines about consumer influence.

> ***Company E: "Don't be led by consumers****. We can no longer reply on consumers to drive market change."*

After all, it was made clear that sustainability do not necessarily always come before consumer.

> ***Company E:*** *"Sustainability doesn't always win when difficult decisions have to be made. But it's always considered.* ***Challenges are desirability and sustainability.****"*

c) Equal sustainability emphasis in brand portfolio

Different weight on sustainability emphasis in company's brand portfolio was also witnessed in case C and D.

Firstly, case C had no strategy for sustainability-focused brands. All the brand strategies were purely consumer-insight based, and all sustainability focus was applied strictly only when it falls into the target consumers' interest.

> ***Company C:*** *"We have no brands with a sustainability elements in its equity.* ***None of them has a sustainability message at their core.*** *But they do have an important message of sustainability sometime in their projects. The detergents have a clear focus of adding sustainability element to it because people understand that… It's not because they want to sell. And it will be brought into*

the benefits being delivering by that brand. It's hard to imagine how you will win with that message alone. We could have an eco brand like Ecover. But we don't because we believe that need to deliver the benefits that consumers want... but we don't want to sell them on the basis of being sustainable."

Case D showed more common pattern of concentrating sustainability focus to certain ratio of the brand portfolio.

Company D: "*We have a couple of brands which have a strong sustainability focus. One is anti-animal test cosmetics brand and it's doing quite well in the market. The other one is a house cleaning products brand launched years ago. Maybe it was been too early in the market; it's a failure case though. It's almost defunct now."*

Other than these two brands, sustainability focus did not obviously appeared in other sub-brands in case D's brand portfolio.

Case E had no evidence in this element as the business runs a range of products under one brand rather than many separate sub-brands.

d) Marketing dominance avoidance

The domination of marketing department at the front-end of NPD was less conspicuous in the cases of Phase 2 except case C. Case C and E gave an equal power to other functions such as R&D and design.

Company C: "*Usually we do brief writing* ***across departments****."*

Case C either had an equal power or R&D was more dominant. Unlike others, marketing department in case C focused on brand equity more than products.

Company C: "*R&D brings the ideas. The key connection is between the R&D and consumer. The initial idea generation is the R&D function in here. The marketing manager focuses on the brand development, and it's absolutely*

critical. And he develops the brand equity. Anything that comes out of here has to fit with that."

Case D only followed the pattern of Phase 1: marketing takes the lead in the idea generation and is most powerful in making decisions.

> ***Company D: "The mar*keter controls** *the designers..* ***.*** *We are marketing-oriented company. They are like 'Design? Whatever! As long as we make money!'… It's marketers who start the NPD. They usually decided everything from the product concept and design specifications and toss it to designers… The marketing vice-president is the highest in the process. This person comes into the gates. All the decisions are made by the marketing director."*

Case E did not let the marketing department lead the NPD, instead, the idea generation comes from the innovation department.

> ***Company E: "Innovation*** *department initiates the ideas. And brand comes in. I (packaging developer) come in****. Everyone comes in****. Brand sometimes initiates it."*

e) Economy of scale flexibility

For some cases, the economy of scale was an issue, either too large or small. Case C and D considered themselves too big to afford the expenses for changing manufacturing facilities while case B (from Phase 1) perceived themselves too small to afford the material cost. Company A and E didn't provide any evidence regarding the size constraint.

Case C concerned about their global-sized manufacturing system: installed capacity, and the high cost entails to the change to adopt sustainable solutions, e.g. environmentally responsible materials, manufacturing processes.

> ***Company C: "****FMCG is relative well-established business sector and it has something called installed capacity. Sustainability often requires a significant*

challenge. In order to use an entirely degradable detergent packaging, you have to completely change the installed capacity because you can't handle the packages in the same way (in the manufacturing facilities). It's entirely [sic] technically feasible but the application of that our installed capacity is ***extremely expensive*** *because the installed capacity is* ***too big****. The scale is too much. So there is no way that we would implement that sustainability change even if it were a good thing… because of the cost. So in here, that would be the problem. So the case of FMCG, the place to look for radical sustainable design implementation is in tiny companies who can implement leading-edge thinking from a sustainability point of view without the need to change the significant capacity. The implementation of the change in some other industry is easier. The hurdle is less. If what exists today is big and already installed and using a lot of materials, it's much more difficult."*

Case D experienced the same challenge of size that sustainability implication brings.

*Company D****:*** *"Once I ran a successful bio plastic packaging project. But the company later capsized the project and said 'Just use the normal plastic.' The company was able to do it, but they didn't want because it needs* ***a huge investment with no clear profit.*** *They think 'Why do we have to? What's the worth of the effort to change the production line when we can make money just like this?' For last a few years, we had lots ideas. But it's* ***only*** *feasible when the* ***cost goes down****."*

Case E did not provide any evidence about the concern around it. This is attributable to the nature of question that has asked the challenge that they were facing. Case E did not perceive the economy of scale as a challenge, but took the matter into account with **greater flexibility**.

Case C and D showed less flexibility in adopting sustainability into their economy of scale business plan.

f) Speed constraint flexibility

As stated in the analysis of Phase 1 (see Section 4.5.10), an ability to launch new products is the key to the success of the business in this sector. Case C addressed the stress about time constraint, and consequently sustainability did not appear as important as speedy NPD.

> ***Company C:*** *"The consumer goods have to be done really quickly. Applying sustainability one by one is a* ***pure luxury****."*

The low priority on sustainability was also witnessed in case D.

> ***Company D: "****My company is too busy to think of sustainability…* ***It's so rapid*** *here. We don't even have time to do a proper consumer observation. An NPD normally takes three-four months. We usually set a deadline and try to meet it. It's a huge pressure. So short."*

Besides, not only the fast NPD, but also the urge to sell more products to consumers in short time period was witnessed in case D. So the time pressure was both in the internal product development as well as external product consumption.

> ***Company D: "****Product lifecycle?* ***The shorter, the better.*** *So that they will buy again!"*

Case E did not provide any evidence in the stress about the rapid product launch. This is partly due to the passive data collection in this subject matter. Similar to the prior factor (the economy of scale flexibility), the subject was extracted from a question about 'challenges' than from a direct question about a time constraint. Thus only those cases that find speed constraint a challenge against sustainability practice acknowledged it. The base line for the speedy NPD is similar within this sector after all.

Naturally companies are economic organisations that pursue profitable activities, however, high speed in the NPD process can pressurise other issues, which takes up time. Flexibility of such time constraint is considered to be critical to keep the sustainability consideration throughout the NPD process.

5.3.11 Factor 11: Maturity of external contexts

Phase 2 findings verify the first phase findings with a range of evidence. Issues regarding maturity of external context are reported in all cases (See Table 5.11). Case C had a less mature consumer and market, while the infrastructure was mature. Case D was suffered from immature consumer and market, but the view on infrastructure maturity was mixed. For case E, the maturity of both consumer/ market and infrastructure was positive.

Table 5.11 Assessment of factors and elements of maturity of external contexts in case A to E

Factors	Elements	IN-DEPTH		VERIFICATION		
		Case A	Case B	Case C	Case D	Case E
11. Maturity of external contexts	a) Consumer/ market maturity	N/A	NEGATIVE	NEGATIVE	NEGATIVE	POSITIVE
	b) Maturity of infrastructure	NEGATIVE	NEGATIVE	POSITIVE	NEUTRAL	POSITIVE

a) Consumer/ market maturity

An informant from case C revealed that company C is not targeting the sustainability-conscious people, claiming the majority will not give priority to sustainability. In other words, case C would have been focusing on more sustainable products, if only consumers are mature to cherish sustainability aspects in the products.

> ***Company C:*** *"Our target consumers* ***do not favour sustainability*** *over others. Ecover is a small brand. If there were a lot of consumers who are prepared to prioritise sustainable design over performance, then Ecover would be a bigger brand."*

The target consumers in case D appeared similar to those of case C. Consumers in case D showed a high price sensitivity.

> ***Company D: "****Our target doesn't care about sustainability. I don't know Korean customers. They say eco, environmentally-friendly, but they just buy the cheapest one. Our consumer research also says, 'I bought it just because it was on buy 1 get 1 free offer.'"*

Also, case D consumers were suspicious about the performance of so-called eco-friendly products. This can hinder the company to pursue and convince consumers in this regard.

> ***Company D:*** *"In the end, the company grows when consumers want more and buy more. But the* ***consumer suspects the performance*** *of eco-friendly detergent. Maybe it's marketer's responsibility. They could lead the market, but there is no one with such mind."*

Case D consumers are lack of knowledge in sustainability and their consumption. On the press release about one of their sustainable product brand, which turned out to be not successful, the company stated that

> **Company D:** *"Market for sustainable products has just begun in Korea. We don't have enough social awareness or regulation such as environmental certificate system. There is a limited chance to access consumers hence limited marketing activities***.***"*

> ***Company D:*** *"Our* ***consumers don't know about sustainability well enough****. Sometimes corporate leads the consumers, but most of the time, we respond to their needs. So consumer perception is really important… If they want, we cannot help but cater for it!"*

This claim is related to the above element (Section 5.4.10 a) **Balanced reliance on consumer insight**).

In case of E, their target consumers seemed similar to those of case D, in terms of price-sensitivity.

> ***Company E: "****They say very positive. Our consumers are* ***quite caring****… Consumers always say that they want sustainability, but they* ***rarely make sustainable choices when they buy things.*** *So if you ask consumers if sustainability is important they will all say yes, especially our consumers. But if you put the products in front of them and ask them to buy one, they will buy*

one on other factors than sustainability. Although they say it's important, their purchase decisions are different in reality."

b) Maturity of infrastructure

Case C turned out to be content with the infrastructure. But again, optimising for more sustainable solution can be a different story.

> ***Company C:*** *"Oh, we've got great infrastructure to support the implementation of anything inside the company, the manufacturing capability or this kind of things… But it's the matter how we can change our factories and manufacturing systems."*

For case D, one informant agreed on the sufficient infrastructure. However, just as case C, the cost of optimising appeared to be a roadblock for them.

> ***Company D****: "In fact, the infrastructure is sufficient. Our factories can do it. We just avoid it because it costs too much. They think we can still make money without such a huge investment, why bother changing? Also, the factories are quite conservative. They've been working there at least for 20 years. They sometimes say they cannot do, when it's not true. Simply because they don't like change."*

In other words, it can be concluded as immature infrastructure for sustainability in case D.

> ***Company D: "****No infrastructure for sustainability****."***

Case E was rather content with their infrastructure, especially in respect of recycling. The informant agreed on the possibility to improve the status quo, but this cannot be suggested as a roadblock.

> ***Company E: "****Recycling is good but could be better. We actually buy the recycled material from outside UK, we have two suppliers and one of them is*

European-based. We need better quality recycling… Compared to other countries, UK is pretty good in terms of available recycled materials or recycling facilities. In terms of the availability of the raw materials it's pretty good. In terms of collection of materials is also pretty good, it could be better."

5.4 Summary of verification studies findings

In chapter 5, the findings from Chapter 4 are verified. This chapter sets out the outcomes of data analysis of three FMCG companies. As the second findings elaborate and confirm Phase 1 findings, the 11 factors and 32 elements share the same list as Chapter 4 (see Section 4.4 for summary of the findings).

The selected case companies strictly based on the selection criteria represent a wide range of sustainability maturity levels (SML) from different regional contexts. Case C is a multinational at SML 2, while case D is a South Korean company at SML 1.5, and case E is a British company at SML 4, according to the SML model that had been established earlier (see Section 3.6.1). The variety of contexts and levels of the sample of organisations allows diverse insight at multiple perspectives that resonates the findings of the previous chapter.

Also, the assessment of data (Table 5.1-5.11) across all cases is presented in each section rendering a comparison of the dispositions (e.g. positive, negative, or n/a) of each case for factors and elements. This also enables the author to obtain a holistic perspective of the overall tendency and quality of supporting evidence in the factors and elements across the cases.

The following chapter synthesises the findings from Chapter 4 and 5, and poses key findings with a conceptual framework that encompasses the relationships between the relevant factors.

6. Discussion

This chapter provides the synthesis of the key findings, the responses to the research questions, as well as a suggestion of a conceptual model of the findings. How the gaps are addressed is followed by a summary of discussion.

6.1 Key findings

The focus of this research is to identify the influencing factors for sustainable design implementation in the front-end of new product development (NPD) process within the fast-moving-consumer-goods (FMCG) sector. In order to gain profound background knowledge, a preliminary literature study was conducted across several epistemic communities. This cross-disciplinary literature review revealed that a substantial number of factors encompass one another and share commonalities across sustainable design literature, corporate social responsibility (CSR) research, and NPD front-end studies. An empirical study followed to confirm and elaborate the literature findings within the FMCG environment.

The results conclude with 11 factors and 32 elements[17]. Nine factors and 19 elements confirmed the previous findings. To the best of the researcher's knowledge, two factors and 13 elements are newly identified[18] in this study (see Table 6.1).

[17] 'Elements' are used to describe the constituents particularly extracted from the current research context: sustainability and FMCG.
[18] Highlighted in grey in Table 6.1

Table 6.1 Consolidation of influencing factors and elements for sustainable design at the front-end of NPD within FMCG

COMMON SD &FRONT-END FACTORS	SUSTAINABILITY & FMCG elements
1. Senior Management support	a) Firm sustainability leadership
	b) Understanding of sustainability principles
	c) Rewarding individuals for sustainability achievement
2. Sustainability vision	a) Alignment with company's general vision
	b) Disseminated throughout company philosophy and daily activities
3. Internal communication	a) Healthy inter-personal relationship
	b) Variety of channels
4. Cross-functional team	a) Sustainability officer involvement
	b) Equal level engagement
5. Supportive corporate culture	a) Transparency
	b) Legacy
	c) Behaviour
	d) Belief
	e) Structure
	f) Citizenship
6. Individual attitude	a) Motivation based on the company's past sustainability practice
	b) Satisfaction about company's present sustainability practice
	c) Ambition about the company's future sustainability practice
SD FACTORS	**SUSTAINABILITY & FMCG elements**
7 Sustainability Champion	a) Official vs. voluntary
	b) Project level involvement
8. Sustainability tools	a) Customisation for company context
	b) Timely introduction
9. Clarity of terminology	a) Agreed definition on sustainability terminology
	b) Sense of sharing the same goal
FMCG FACTORS	**SUSTAINABILITY & FMCG elements**
10. Balanced focus on growth	a) Careful balance of Triple Bottom Line
	b) Balanced reliance on consumer insight
	c) Equal sustainability emphasis in brand portfolio
	d) Marketing dominance avoidance
	e) Economy of scale flexibility
	f) Speed constraint flexibility
11. Maturity of external contexts	a) Maturity of consumer / market
	b) Maturity of infra-structure

Four of the novel elements (i.e. *firm sustainability leadership* within the senior management support factor, *equal level engagement* within the cross-functional team factor, and *satisfaction about company's present sustainability practice* and *ambition about the company's future sustainability practice and Ambition about the company's future sustainability practice* within the individual attitude factor) are applicable to the sustainable design and front-end NPD context. Next two elements such as *project level involvement* within the sustainability champion factor, and *sense of sharing the same goal* within the clarity of terminology factor are novel are in the sustainable design implementation context. Two factors and the remaining seven elements are exclusively applicable to the FMCG context. The factors and elements are presented in three groups including common sustainable design (SD) & front-end factors group, sustainable design factors group, and FMCG factors group. The details of each factor and elements are discussed further in the following section directly addressing Research Question 1,2 and 3.

6.2 Responses to research questions

This section presents how the summary of key findings directly responds to Research Question 1, 2, and 3. Research Question 4 is addressed in the later part.

6.2.1 Research Question 1:

Common Sustainable design & front-end factors and elements

> What are the influencing factors for the *front-end of NPD process* identified in previous research and how do they apply within the FMCG sector?

Six commonly influencing factors for NPD front-end and sustainable design such as *senior management support, sustainability vision, internal communication, cross-functional team, supportive corporate culture,* and *individual attitude* confirmed the previous research. These common factors are confirmed and elaborated with 18 elements within the case studies.

1. Senior management support

Successful sustainable design implementation from the front-end of NPD takes place when there is sufficient senior management support. The critical role of top management has been repeatedly stressed both in sustainable design literature (McAloone and Evans, 1999; Boks, 2006; Lee-Mortimer and Short, 2009) and the front-end NPD research (Khurana and Rosenthal, 1998; Kim and Wilemon, 2002; Felekoglu and Moultrie, 2014).

This study suggests the inclusion of verbal / non-verbal actions and mind-sets of the senior managers in three elements within the FMCG environment as below.

a) *Firm sustainability leadership*

   If the leadership **does not** stay firm once sustainability goals and strategies are determined, the profitability issue can easily kick in and undermine the sustainability motivation. Strong leadership also strengthens the middle managers' support for sustainability practice to be put into operation.

b) *Understanding of sustainability principles*

   Top managers' general understanding of fundamental sustainability principles has a substantial impact on managerial decisions. A lack of understanding the principles can hinder implementation of sustainability practice in a concrete and constant manner. Short *et al.* (2012) support this by saying 'the person with authority to change the process is now faced with his/her own risks of imposing

DfS/E (Design for Sustainability/ Environment) into the design process, and so it is **their** understanding of the benefits that becomes crucial… (pp. 349)'.

c) *Rewarding individuals for sustainability achievement*

Financial incentive system for individual improvement in sustainability practice ensures senior managers to encourage employees.

As opposed to Verhulst's PhD study (2012) that presents three successful cases of bottom-up approaches of sustainable design, all five FMCG cases in this study coherently revealed that the top-down approach is critical in the long-term execution of sustainability practice during NPD. The difference in the results is assumed to be related to the different sample company sizes, and company environments.

2. Sustainability vision

Successful sustainable design implementation from the front-end of NPD takes place when a coherent sustainability vision is provided from the top. The permeated and well-aligned sustainability vision to company's general vision and company culture is the 'proactive approach to sustainability' that Maletic *et al.* (2014) categorised as one of the sustainability exploration constructs. The elements of sustainability vision are:

a) *Alignment with company's general vision*

Mid-to-low SML companies often had separate visions for their business and for their notion of sustainability, where the latter was not recognised by the majority of employees.

b) *Dissemination throughout company philosophy and daily activities*

A deep permeation of sustainability vision within the company in what the company believes and how employees behave in their daily activities emerged in high SML companies.

This study reveals a recurring pattern between high and mid-to-low companies; high SML companies have better awareness and embodiment of their sustainability vision, and this often overlaps with the company's general vision.

3. Internal communication

Successful sustainable design implementation from the front-end of NPD takes place when visions of sustainability are well communicated internally. The current study confirmed the previous research findings (Khurana and Rosenthal, 1998; Kim and Wilemon, 2002; Johansson, 2002; Lenox and Ehrenfeld, 2000; Tien *et al.,* 2005) and elements are as below:

a) *Healthy inter-personal relationships*

   Ease of access between hierarchical positions, and constant communication between horizontal positions within the NPD process are conducive to healthy inter-personal relationships. Schneider *et al.* (1998) support the importance of mutual trust based on the inter-personal relationship in their sustainability and organizational change studies. Healthy inter-personal relationships provide the first step for open discussions of sustainability issues.

b) *Variety of channels*

   A range of open communication through formal communication channels such as weekly briefings, monthly meetings, and project presentations, as well as informal channels including casual conversations, email responses, and quick requests are important for successful NPD in general.

This study showed that healthy internal communication was emphasised at the corporate level and well executed at the project level in most cases regardless of the sustainability maturity level.

4. Cross-functional team

Successful sustainable design implementation from the front-end of NPD takes place when the NPD team is made up of several functions such as marketing, R&D, design, supply chain, sales and manufacturing. The elements regarding cross-functional team are as below:

a) *Sustainability officer involvement*

A debatable point is the involvement of sustainability officer / department at the project level. All the cases had an official sustainability department at a corporate level, but they did not join in the NPD. Instead, in low-to-mid SML cases, they only dealt with public corporate images. Noticeably in the high SML cases, they provide sustainability guidelines for NPD practitioners.

b) *Equal level engagement*

Equal involvement and empowerment of various functions *from* the *beginning* of NPD is ideal. But even in some high SML cases, the initiation of NPD projects was a job solely for the marketing department. In another case, equal empowerment was dismissed as being allegedly slowing down the decision making process during the NPD.

Cross-functionality is viewed to be highly relevant both in sustainable design studies (Borsboom, 1991; de Ron, 1998; McAloone (b), 1998; Stoyell *et al*., 1999 Johansson, 2002, Brones *et al.,* 2014; Maletic *et al.,* 2014) and NPD front-end studies (Cooper and Kleinschmidt, 1991; Khurana and Rosenthal, 1998; Kim and Wilemon, 2002; Cooper, 2008). For example, Maletic *et al.* (2014) see cross-functional structure as one of the sustainability exploration constructs that enable company to develop sustainability innovation competencies. This research confirms these previous findings. However, none of these studies managed to address the equality of the involvement level of disparate functions and their respective power in decision-making. Moreover, a detailed look into how cross-functionality works in the case companies renders a new

question about the notion of true cross-functionality. For instance, no active involvement of sustainability officer who has the decision power such as manager or directors was witnessed in all cases, despite this has been assumed to be obvious. In many cases, the front-end would be further divided into minute stages where different teams worked at different stages instead of being cross-functional all the time.

5. Supportive corporate culture

Previously named as the "soft side" by Boks (2006), or the "environment" by Lee-Mortimer and Short (2009), the notions about the 'intangible' side of the working ambience share commonalities with corporate culture. Successful sustainable design implementation from the front-end of NPD takes place when there is a supporting culture of sustainability at the corporate level. In order to foster debates over whether to adopt sustainability practice and design into business, the supporting corporate culture is critical. This is only gained by the accumulation of shared values and beliefs, norms and behaviour over time (Schwartz and Davis, 1981; Deshpandé and Webster, 1989). The six elements of sustainability corporate culture are as follows:

a) *Transparency*

Transparency means a public disclosure of financial administration, revenue streams and business practices in general business terms, as well as information on the manufacturing processes, material supply chain, waste management, energy usage, and the social and environmental impact of products. All case companies had a positive culture towards transparency.

b) *Legacy*

This research defines legacy in sustainability as 'the accumulation of sustainability practices within the company over a period of time'. Legacy influences the motivation for sustainability-enthusiastic employees to join the company, and cultivates pride while working for the company. High SML

companies tend to have a strong legacy, and the employees are well aware of it.

c) *Behaviour*

Sustainability behaviour, in this research, refers to the commitment present in the company / employees daily practices. This includes various internal and external sustainability-related activities. Witnessed internal activities include carpooling, cycle-commuting, waste reduction, provision of quality food and welfare services. External activities mainly include philanthropic works such as regular charity donation, and social care volunteer events.

d) *Belief*

The object of commonly held beliefs within a corporate can vary from sustainability to business growth or more. High SML companies tend to believe in their sustainability practice and its future influence, whilst mid-to-low companies' beliefs are rather focused on meeting consumer's needs first and foremost.

e) *Structure*

For a long-run execution of company's goal, vision or belief, a systemized structure is critical. From sustainable design perspective, structured approach enables sustainability to be recognised as a functional requirement, and help minimise the chance of being just a design criterion (Deutz *et al.,* 2013). This provides sustainability an inherently fundamental proposition in design solution process (Deutz *et al.,* 2010). Maletic *et al*. (2014) view the systematic integration of sustainability heightens company's process efficiency. In this research, high SML companies tend to be in the process of structuring detailed procedures to convey specific sustainability requirements, if they were not perfectly equipped at the time.

f) Citizenship

Mirvis and Googins (2006) define corporate citizenship as balancing the expectations of stakeholders with managing of a successful business, synonymising with corporate responsibility, sustainability or the triple bottom line. High SML cases are well oriented to become the leading light exemplar to society and other businesses.

6. Individual attitude

Along with the supporting corporate culture, individual attitudes another intangible success factor for sustainable design implementation at the front-end of NPD within FMCG. In addition to motivation that van Hemel (1998) and Johansson (2002) singled out as a critical success factor for sustainable design adoption, this research adds satisfaction and ambition as constructs of individual attitude as below:

a) Motivation based on the company's past sustainability practice

Individual's sustainability motivation based on the sustainability legacy throughout the company history brings out active sustainable actions. Employees at the high SML companies tend to have already known about their company's sustainability reputation before joining, and some reports their increased enthusiasm after joining the company (case A).

b) Satisfaction about company's present sustainability practice

The employees at the high SML companies take pride about their company's current execution of sustainability practice. They show high satisfaction as well as high enthusiasm.

c) Ambition about the company's future sustainability practice

The employees at the high SML companies tend to be more ambitious about how the company should be in the future. Although they are happy with what

the company does, they want to push the boundary further, as sustainability is a relative concept.

Although assessing individual's mentality was challenging, through probing and comparing the details of interview transcription, it was possible to distinguish the recurring patterns that were captured among high SML companies' individual informants.

6.2.2 Research Question 2:
Sustainable design factors and elements

> What are the influencing factors for sustainable design implementation identified in previous research and how do they apply within the FMCG sector?

Three influencing factors for sustainable design implementation were identified in the literature: *sustainability champion, sustainability tools* and *clarity of terminology*. These factors are confirmed in the case studies and elaborated with the elements that are specific to the front-end stages of the NPD process within the FMCG environment. While the earlier group of common factors are found at the organisational level, this group of factors applies to the operational level of sustainable design implementation with a direct influence during NPD.

1. Sustainability champion

Successful sustainable design implementation from the front-end of NPD takes place when there is an active sustainability champion. Consolidating a number of academic research both in NPD (Moenaert *et al*., 1995; Khurana and Rosenthal, 1998; Kim and

Wilemon, 2002), and sustainable design (Lenox and Ehrenfeld, 1997; McAloone *et al*., 1998; Simon *et al*., 2000; Johansson, 2002; Pujari *et al*., 2003), this research suggested sustainability champion (environmental champion/ coordinator/ advisor) as a person who is in charge of helping and encouraging sustainability consideration into design within company or projects. The champion can be officially appointed or voluntarily engaged in the project to provide sustainability motivation and knowledge.

a) *Project level involvement*

In some cases, the corporate sustainability officer is considered as a champion. However, if the officer's job remains at the corporate level and do not actively get involved in the NPD project, it is unlikely that this person can meet the daily necessity of the NPD team regarding sustainability information or solutions.

b) *Official vs. voluntary*

As opposed to many academic claims, none of the cases has this position as official when it comes to the project level. In cases where there was one, they were all voluntary. Ideally, this person will not need to exist if every NPD member is knowledgeable in various aspects of sustainability. Verhulst's study (2012) reveals a similar pattern in terms of sustainability ambassador being either official or voluntary in her case studies.

An interesting observation among the mid-to-low companies was that they do not feel the need of such a person. This is because most of the NPD projects are conducted in a business-as-usual manner without much sustainability challenges. As 'mid-to-low' implies by definition, a better performance is expected from them. This research still argues the advantage of having such a person as a proactive reference / motivation point. However, not enough evidence is presented to give a conclusive decision whether an official position is needed or a voluntary role is sufficient.

2. Sustainability tools

Successful sustainable design implementation from the front-end of NPD takes place when sustainability tools are appropriately used. Customised tools that fit into the company's NPD context help address many sustainability aspects effectively. Also a timely introduction at an appropriate timing is critical for busy NPD processes.

a) *Customisation for company context*

   As addressed by almost every case company and within academia, often tools are too complicated, and do not fit into the company's own NPD needs and environment. High SML companies tend to be more proactive in tool utilization through customization of existing tools or developing their own.

b) *Timely introduction*

   Although sustainability tools help companies adopt sustainability aspects into the NPD more efficiently, it can slow down or complicate the NPD process. Early introduction of sustainability tools tend to be avoided, except in case A where an eco design workshop took place at the front-end of NPD.

The empirical study of this research shows a clear polarized view on sustainability tools between high and mid-to-low SML cases. High SML companies utilize tools and appreciate the benefit of using them, while lower-level groups show a lack of knowledge in any tools (or tool itself) hence have low expectation. As discussed in Section 2.7.6, a plethora of sustainability tools exists, and many researchers admit the need of a more balanced development of tools. Confirming the discrepancy between high and mid-to-low SML companies is one of the meaningful discoveries of this research.

3. Clarity of terminology

Building upon contrasting academic views over the numerous terminologies and definitions regarding sustainability-related design activities (see Section 2.6.4 and Appendix A), this research attempts to verify whether successful sustainable design implementation from the front-end of NPD is influenced by a consolidated (or mixed) use of sustainable terminologies and definitions in industry practice.

a) *Agreed definition on sustainability terminology*

Consolidating terminology and definition may potentially reduce the confusion within the NPD team, as well as between company and consumers. This is backed up by Short *et al.* (2012), which acknowledged the lack of prevailing understanding of sustainability terms. The consequent gap of understanding between academics and 'people on the factory floor' clearly exists.

b) *Sense of sharing the same goal*

Data shows that different terminologies are used in a mixed fashion, and in contrast to author's prior assumption, many informants in this section argue that key is to understand each other regardless of terminologies. Thus a sense of sharing the same goal is seen to be important even if such goals are not addressed in the same way.

Nevertheless this research suggests the importance of an agreed use of terminology and definitions. In essence, one needs a lexical device of language to convey the meaning. Given that one of the measures of maturity of sustainability is the existence of a long-term goal within the company, the importance of clarifying what they want to deliver, and sharing it with stakeholders in a consolidated fashion cannot be overemphasised**.**

The empirical study reveals two serious discrepancies; a) in commonly used terminologies among the NPD members, company and consumers respectively in most mid-to-low SML cases, b) in the academic definitions and the industry practitioners'

understanding in all cases (see Section 4.5.9 and 5.4.9). The most commonly used term and typical design emphases do not align with one another. Also the perceived importance of using an agreed sustainability terminology remains inconsistent in a majority of cases. However one of the interviewees did emphasise the need of clarity of specific terms, advocating the yet unrealized necessity of clear sustainability terminology.

6.2.3 Research Question 3:
FMCG factors and elements

> What are the distinctive factors for sustainable design implementation within the FMCG sector?

Two influencing factors *balanced focus on growth* and *maturity of external contexts* are identified as specific for to the sustainability practice at the front-end of NPD process within the FMCG context. Unlike the two above factor groups are confirming the previous findings (In Research Question 1 and 2), these factors and elements are originally formulated during the empirical study. Whereas all other factors can be suggested as success factors that accelerate the success of product or project, these two factors are deeply connected to the fundamental nature of business practices. Thus a proper execution seems to require determined commitment; otherwise these factors can be laid out as roadblocks that hinder company's thorough sustainability practice.

1. Balanced focus on growth

Successful sustainable design implementation from the front-end of NPD takes place when a growth is pursued with a balanced focus. Growth is a common goal for all the case companies in this study, while a difference lies in the balance of the focus.

a) *Careful balance of Triple Bottom Line*

Although growth is a much-debated concept in sustainability research, the nature of business is to grow bigger. High SML companies tend to be careful about the balanced pursuit of growth in three aspects of Triple Bottom Line: environmental responsibility, social benefits, and economic viability.

b) *Balanced reliance on consumer insight*

Consumers and their reactions constantly impact the profitability of business. However, a blind reliance on consumer insight can undermine the sustainability aspects at the stage of product development, especially when consumers do not have much interest in sustainability. The high SML companies clearly show their leadership in consumer relations and do not thoroughly rely on consumers' demand.

c) *Equal sustainability emphasis in brand portfolio*

80% of the case companies show higher concentration of sustainability aspects in certain brands than others within their brand portfolio. Although it is difficult to confirm that equal emphasis is critical at the moment, the offsetting of environmental / social impacts between brands may not avoid the risk of a green-washing allegation.

d) *Marketing dominance avoidance*

Dominant power in decision-making of the marketing department at the front-end of NPD is conspicuous in some cases. Not only is this contradictory to the

emphasis on cross-functionality of the team, but can also jeopardise sustainability aspects. Marketers tend to prioritize profits over sustainability.

e) *Economy of scale flexibility*

At the mid-to-low SML companies, the size of their production / manufacturing facility discourage the investment in sustainability practice. Either the vast size and its high cost or nominal production volume to afford a bulk sustainability material/ ingredient are pointed out as two major challenges. However, the high SML companies do not take it as an excuse because flexibility to prioritise their sustainability goal is ingrained. Flexibility in handling the cost for sustainable design implementation while taking advantage of the economy of scale can be win-win strategies.

f) *Speed constraint flexibility*

As the title of the sector (i.e. Fast-Moving-Consumer-Goods) explicates, high speed NPD characterises this area, producing products at a fast turnover is critical for a business success. However, companies that are inflexible with time are likely to dismiss the sustainability consideration during the busy NPD process.

2. Maturity of external contexts

Maturity of external contexts such as consumer, market, and infrastructure plays an important role in successful sustainable design implementation in the front-end of NPD. Cases show that the success is inevitably limited without supporting external contexts such as maturity of consumer/market or infrastructure.

a) *Maturity of consumer / market*

If the target market or consumers are not mature enough to acknowledge the sustainability features of the product, and make purchase decisions accordingly,

the company can easily jeopardise their economic sustainability. This resonates well with Short et al.'s (2012) findings on 'no apparent requirement from market or customers' as one of the top three hindering factors for company's adoption of sustainable design approach.

Some of cases e.g. case B, D, and E, regardless of their SML, provide evidence of the knowledge-behaviour gap (Kollmuss and Agyeman, 2002). Consumers often make purchase decisions that do not align with what they believe or say. The fact that FMCG products require low investment and involvement can accelerate this phenomenon.

b) Maturity of infrastructure

Regardless of the enthusiasm of companies, without national level infrastructure, often through governmental support, the sustainability practice can experience restrictions. Sustainability is such a complex and interrelated concept, that no single stakeholder can tackle all the issues solely.

Unlike any other factors mentioned above, corporates can only take a passive stance regarding this external factor. However, the difference lies in their attitudes toward such issues. High SML companies tend to overcome the challenges whilst mid-to-low SML companies tend to use it as a pretext for putting sustainability practice aside.

6.2.4 Research Question 4:

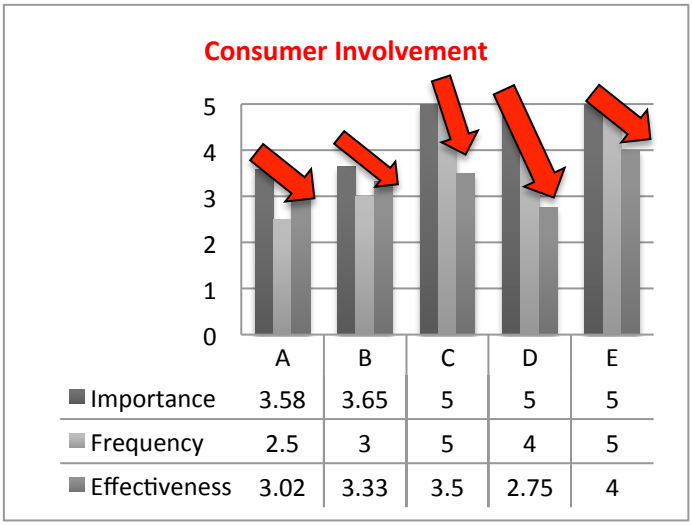
Perceived importance vs. reality in practice

How are the factors applied in practice across companies of differing sustainability maturity levels?

In order to answer Research Question 4, results from the quantitative data are synthesised at two levels: within factors, and within case companies. First, a disparity between the perceived importance and practice in reality of each factor is identified. For more than 2/3 of cases, the perceived importance of the factor scores higher than actual frequency or effectiveness. Second, recurring patterns of negative, positive or neutral data according to the various sustainability maturity levels of cases are observed. In other words, the higher SML the company is, the more positive data is provided.

a) Within factors: lofty ideals

A synthesis of 43 column charts of *importance, frequency* and *effectiveness* of each factor in five respective cases reveals a predominantly downward trend (see the red arrows in Figure 6.1 for an example).



	A	B	C	D	E
Importance	3.58	3.65	5	5	5
Frequency	2.5	3	5	4	5
Effectiveness	3.02	3.33	3.5	2.75	4

Figure 6.1 Example of a downward trend of factor aspects from left to right (consumer involvement)

Appendix J visualises the synthesis by a consolidation of 43 column charts, 30 columns out of total 43 (69.8%) scored importance higher than frequency or effectiveness. Especially, all cases (five out of five or two out of two) of certain factors such as *consumer involvement, sustainability vision, supportive culture, sustainable design*

practice, and *individual attitude* are in the downward trend*,* whilst four out of five cases are in *senior management support, internal communication*, and *cross-functional team.* This downward trend of over 2/3 of cases represents the difference between obligation (perceived importance) and its realization (frequency and effectiveness of the execution). These factors are not being employed as fully as the informants believe they should be.

Among the downward cases, on the premise that the effectiveness scores lower than the importance, effectiveness scored higher than frequency in some factors such as *cross-functional team* in case A, B and E, *sustainability champion* in case B and E, and *sustainability tools* in case E. The phenomenon can be interpreted that these factors are being executed effectively, although not often.

Regarding the rest of the columns that is not descending, a number of minor deviances are observed. In three columns out of total 43 (7%) the frequency scored higher than importance or effectiveness. According to the qualitative data, the fact that frequency is higher than the perceived importance means a negative execution of the factor. The informants complain that the factor was overly executed than necessary. For example, regarding *senior management support* the employee level informants in case B tend to interpret senior management involvement as interference rather than support. This is due to the Far Eastern Asian corporate culture of conspicuous hierarchies. In this top-down culture, senior managers gives orders that the lower positions must obey, rather than a support that are free to accept or refuse. Another example is the *cross-functional team* in case C. The informants in case C complain that there are too many decision makers in their NPD, and this often delayed the process.

Four columns out of total 43 (9.3%) scored effectiveness higher than the other two aspects. Two of these cases are in *internal communication* in case B, and *sustainability tools* in case A. However, the difference between the importance and effectiveness is insignificant (0.05 and 0.03 respectively). Two other cases are both in case C in respect to *sustainability champion* and *sustainability tools*. Again these two are insignificant as

case C scored importance of these factors below neutral (2.5 and 2 out of 5 respectively).

One column out of total 43 (2.3%) scores even in all aspects. Case E rates full scores in all three aspects in *senior management support*. This means case E is fully satisfied with this factor in every aspect.

Five columns out of total 43 (11.6%) are not measurable due to a lack of answers in certain aspects. In the two phases of questionnaire session, some factors were investigated in the quantitative format in all cases, and some others were inquired in a different fashion that is more suitable for scrutiny. (The full sets of two questionnaires are available in Appendix C and D.) Thus some cases did not have available quantitative data to complete the column charts. However, the author believes the whole array of the collected data in the consolidated column charts format (Appendix J) still helps expose a meaningful pattern among the data.

To conclude, the synthesis of quantitative data analysis provides a range of valuable insight into the implication of factors within case companies. This quantitative scoring activity and comparison of them help surface a recurring pattern of discrepancy among the perceived importance, and the practiced frequency and effectiveness.

b) Within case companies: the more mature, the more positive

Secondly, as suggested in a fragmented fashion in Chapter 5 (Findings 2), data from each case is assessed in the category of *negative, positive, neutral* or *n/a.*

Table 6.2 shows the consolidation of the data assessment. The cases are rearranged in the order of the Sustainability Maturity Level (SML) (From left to right: the highest to the lowest) for the ease of comparison, in disregard of the original order of the data. Table 6.2 reveals a changing tendency of data categories from positive to negative dominance, from high to low SML cases (see the colour change from green to red via yellow from left to right).

Table 6.2 Consolidated Data Assessment of cases (SML order)

Factors	Elements	Case A SML 4.5	Case E SML 4	Case B SML 3	Case C SML 2	Case D SML 1.5
1. Senior management support	a) Firm sustainability leadership	POSITIVE	N/A	NEUTRAL	NEGATIVE	NEGATIVE
	b) Understanding of sustainability principles	POSITIVE	N/A	NEUTRAL	NEGATIVE	NEGATIVE
	c) Rewarding individuals for sustainability achievement	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	NEUTRAL
2. Sustainability vision	a) Alignment with company's general vision	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE
	b) Dissemination throughout the company philosophy and daily activities	POSITIVE	NEUTRAL	NEUTRAL	NEUTRAL	NEGATIVE
3. Internal communication	a) Healthy inter-personal relationships	POSITIVE	POSITIVE	NEUTRAL	POSITIVE	POSITIVE
	b) Variety of channels	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE
4. Cross-functional team	a) S. officer involvement	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
	b) Equal level engagement	NEGATIVE	POSITIVE	POSITIVE	NEUTRAL	NEGATIVE
5. Supportive corporate culture	a) Transparency	POSITIVE	POSITIVE	POSITIVE	POSITIVE	POSITIVE
	b) Legacy	POSITIVE	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE
	c) Behaviour	POSITIVE	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE
	d) Belief	POSITIVE	POSITIVE	NEUTRAL	NEGATIVE	NEGATIVE
	e) Structure	POSITIVE	POSITIVE	NEUTRAL	POSITIVE	NEGATIVE
	f) Citizenship	POSITIVE	POSITIVE	POSITIVE	NEUTRAL	NEUTRAL
6. Individual attitude	a) Motivation	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	POSITIVE
	b) Satisfaction	POSITIVE	POSITIVE	NEUTRAL	NEUTRAL	NEGATIVE
	c) Ambition	POSITIVE	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE
7. Sustainability champion	a) Project level involvement	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE
	b) Official vs. voluntary	NEUTRAL	NEUTRAL	NEUTRAL	NEGATIVE	NEUTRAL
8. Sustainability tools	a) Customisation for company context	POSITIVE	POSITIVE	POSITIVE	N/A	N/A
	b) Timely introduction	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE
9. Clarity of SD design terminology	a) Agreed definition	NEUTRAL	POSITIVE	NEUTRAL	NEGATIVE	NEGATIVE
	b) Sense of sharing the same goal	NEUTRAL	POSITIVE	NEUTRAL	NEGATIVE	POSITIVE
10. Balanced focus on Growth	a) Balanced reliance on consumer insight	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE
	b) Careful balance of Triple Bottom Line	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE
	c) Equal sustainability emphasis in brand portfolio	NEGATIVE	N/A	NEGATIVE	NEGATIVE	NEGATIVE
	d) Marketing dominance avoidance	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE
	e) Economy of scale flexibility	N/A	N/A	NEGATIVE	NEGATIVE	NEGATIVE
	f) Speed constraint flexibility	N/A	N/A	NEGATIVE	NEGATIVE	NEGATIVE
11. Maturity of external contexts	a) Consumer/ market maturity	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE	NEUTRAL
	b) Maturity of infrastructure	N/A	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE

This tendency is elaborated in Figure 6.2. Green bars (positive) become smaller from left to right, and are gradually replaced by red bars (negative).

From a closer view, the yellow bar (neutral) takes up approximately 1/3 of answers in case B, and relatively larger purple bars are shown in the first two cases in Figure 6.2.

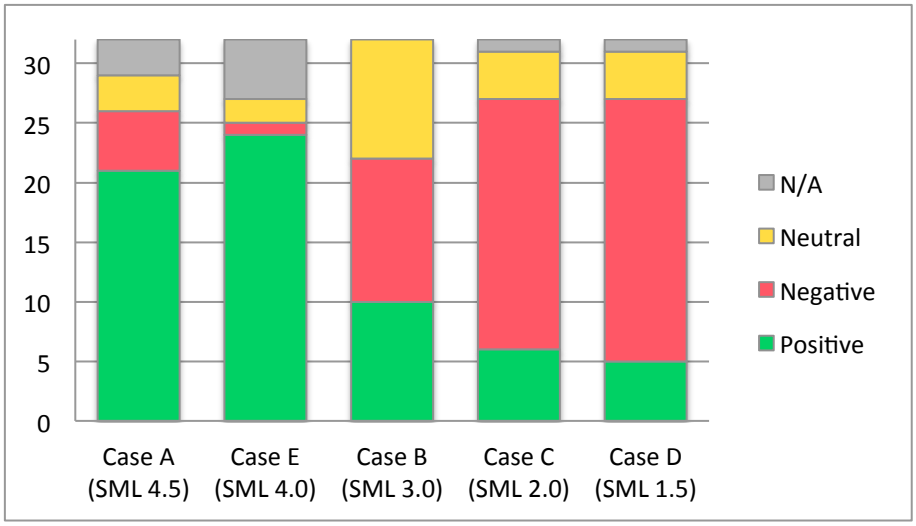


Figure 6.2 Data patterns in 5 cases (SML order)

This is particularly noteworthy as the grey bars (i.e. not available data) are concentrated in the FMCG factors group (see Table 6.2) and this is due to a certain way of extracting the data. This particular group of factors was extracted by a question of challenge. In responding to this question, mid-to-low cases (case B, C, D) singled out the high cost investment caused by the adoption of sustainability practice into their extensive scale manufacturing facilities or material procurement (Factor 10-e), and the speedy pace of the NPD process (Factor 10-f) as their main challenges. However, high SML companies (case A, E) did not address these two issues as challenges during the data collection, resulting in no data for the analysis. These can be interpreted as the difference in the companies' overall attitude and flexibility towards sustainability practice.

To conclude, prior to the empirical study, the initial assumption was that the common SD & front-end factors group would be rather positive across all the case companies.

However, the common factor group did not show any significant difference with the SD factor group or the FMCG factor group in terms of the ratio of positive / negative answers. This is attributable to the fact that the elements of each factor are originated from sustainability practice perspective even if the umbrella factors are derived from general front-end NPD studies.

6.3 Conceptual framework

This section suggests a conceptual framework that depicts the research findings and their interrelationships.

The role of the following framework is to disseminate the study findings more effectively, and present it as guidance to the target audience, mainly the industrial practitioners. The framework also intends to assist the audience in diagnosing complex issues in the sustainable design implementation process within their industry context. Prendeville (2014, Conceptual Model of the Materials Portfolio) is one of the studies that take a similar path by producing a conceptual representation of the research findings in a visual format in the discussion stage.

The framework emerges after all the data collection and analyses are undertaken, not beforehand. In other words, the framework surfaces during the synthesis of the empirical findings, unlike some other studies that explicitly put the conceptual framework before the data collection in order to test it (for example Velhurst, 2012; Vladimirova, 2012).

The general null hypothesis implied in the research questions would be that the weight of each factor is equal, and the factors influence the implementation process independently at an even level of importance, until proven otherwise. Thus, if a framework were suggested at an early stage (e.g. literature review) before data analysis, a different type of framework (e.g. omnidirectional) may have emerged presented as opposed to the present semi-linear type. Instead, the synthesis of factor

analysis reveals that the individual factors do not stand alone, but influence one another in the process of successful sustainable design implementation. The dynamics among them are presented in Figure 6.3.

A chronological pattern for companies to integrate environmental criteria into their design process has been introduced in *Model of Eco design Integration* (McAloone and Evans, 1999). This model describes the organisational changes, proposing three prime components of 1) initial/sustained motivation, 2) communication/information flow, and 3) whole-life thinking. Although the focus of this model is to describe the common sequence of events based on the data from a different context (i.e. electronic/ electrical industry), the proposed three stages provide the basis for the framework that the current research poses. Also, a number of commonality with the current framework (Figure 6.3) was witnessed such as top management commitment, motivation, communication, team working and tools in this model.

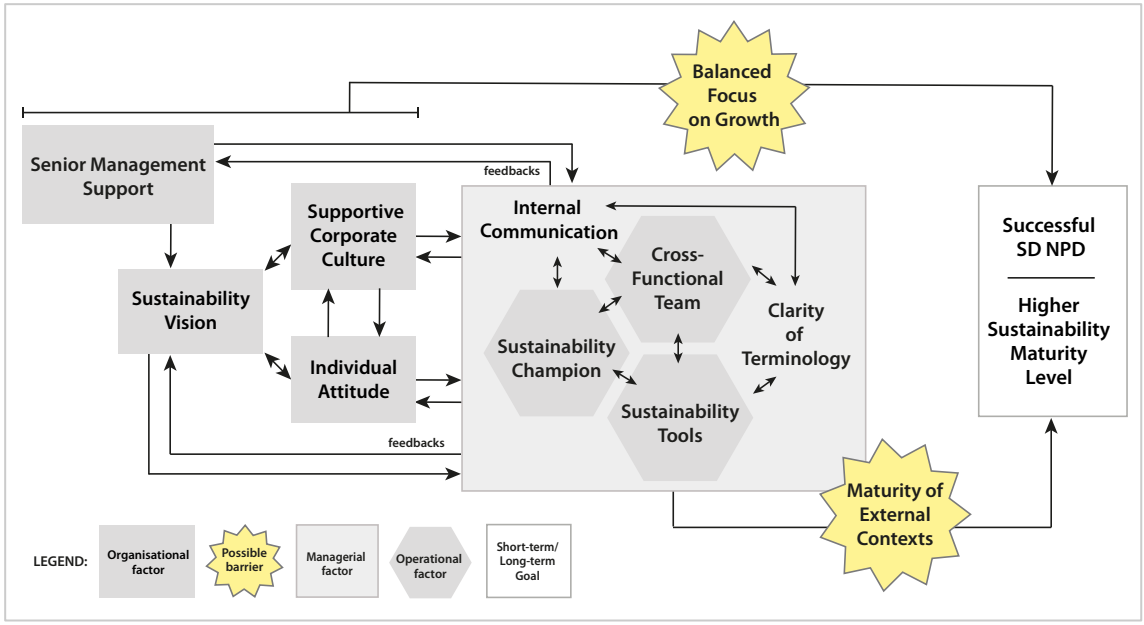


Figure 6.3 Framework of the interrelationships of influencing factors for sustainable design implementation in the front-end of NPD process within the FMCG sector

While the aforementioned *model*[19] *describes* the events in eco design adoption, the below *framework*[20] *explains* the interrelationships of the factors and how they influence sustainable design implementation. This research elaborates their model to the next level of framework with more detailed iterations and multiple factors at varying levels.

The top left of the framework depicts the initial stage of SD implementation. It starts from the group of common sustainable design and front-end NPD factors (i.e. senior management support, sustainability vision, supportive corporate culture and individual attitude).

Firstly, *senior management support* has to be obtained beyond everything as it plays the foremost role in the whole picture of the SD implementation. This is where the top managers at corporates should start reflecting upon in order to enhance their sustainability implementation performance in their NPD process. This includes verbal / non-verbal actions, and mind-set through a) *firm sustainability leadership*, b) *understanding of sustainability principles,* and c) *incentives on sustainability achievement.* This preceding factor is supposed to influence not only the organisational factors but also the operational factors throughout corporate's general activities and the implementation process. Feedbacks from both interact with the factor, too.

Secondly, the senior management support leads to forming *a strong sustainability vision* at the company level. In this research, company vision includes company's business goals and aims. This should a) be aligned with the company's general vision, and b) be disseminated throughout the company philosophy and daily activities. Together with other factors, sustainability vision iterates with the operational factors

[19] A set of concepts, with or without propositions, used to represent or describe an event, objects, or process. (Meredith, 1992)

[20] A collection of two or more interrelated propositions which explain an event, provide understanding, or suggest testable hypotheses (Naumann, 1984) (See Appendix B)

in the process of implementation, and the feedbacks from the processes reinforce the vision in the long-term.

After strong senior management support is secured, and a coherent sustainability vision is formed and disseminated, the vision gradually flows into the formation of a supportive corporate culture and influences the positive individual attitude of employees towards sustainability. Corporate culture forms slowly over time and the six elements that constitute sustainability corporate culture are a) transparency, b) legacy, c) behaviour, d) belief, e) structure, and f) citizenship. As well as the collective organizational norms and behavior, i.e. corporate culture, *individual attitude* is formulated based on the first three factors. Committed individual attitudes accompany the culture and influence each other. The attitudes can be articulated in a chronological fashion such as a) *motivation based on the company's past sustainability practice, b) satisfaction about company's present sustainability practice, and c) ambition about company's future sustainability practice.*

Once senior management support and sustainability vision are gained, *internal communication* has to be ensured to penetrate the sustainability into company's daily routine and the NPD processes. The fluent and active internal communication is based on a) healthy inter-personal relationship and made through b) *various communication channels* such as formal regular meetings, reports, presentations, and informal conversation, emails, one-to-one request. Internal communication influences the entire operation of NPD process, and interacts with clear sustainability terminology.

Along with internal communication, *clarity of sustainability terminology* is another influencing factor at the managerial level. It enhances clear communication among NPD members and also with consumers. Although only one case company was positive on the importance of having agreed definition on sustainability terminology, more companies agreed on the sense of sharing the same goal. This research still strongly argues the potentially powerful impact of clear sustainability terminology.

Subsequently, once the above five factors are laid that make the organisational base for sustainability practice, a range of operational factors come in: sustainable design factors. These four factors identified in this research are not necessarily sequential.

From the front-end of the NPD process, the participation of a *sustainability champion* is recommended. Although this person can be official or voluntary, a level of project involvement must be ensured. Champions play a role as a focal point to get help with *sustainability tools,* and work closely within the *cross-functional team*.

Various *sustainability tools* are supposed to be utilised from the front-end of NPD in order to effectively embed sustainability features into design. Ideally, tools are most effective after customisation to fit into the company's specific context. The timing for introduction is also important, as inappropriate introduction of tools at the wrong time easily fizzle out during NPD. Tools are best utilised in conjunction with sustainability champions. And the tool usage by a cross-functional team enhances the collective understanding and the acceptance of sustainability features into their process and products.

The research reveals that the formation of a cross-functional team is also required. Among diverse functions within an NPD team, a close involvement of sustainability officer with decision power is recommended while ensuring equal level engagement of each function. Within the entire sustainable design implementation performance at the NPD process, three operational factors, i.e. sustainability champion, sustainability tools, and cross-functional team iterate and influence each other. The influence that can be positive or negative also feedbacks into the organizational factors.

Finally, even with the aforementioned factors in place, two groups of FMCG factors can form potential roadblocks. Without enough consideration into them, this group of factors may fundamentally hinder a successful sustainable implementation. They are particularly conspicuous within the FMCG industry especially with consumer orientation and the highly fluctuating market situations, as the title of the industry 'Fast-Moving-Consumer-Goods' clearly demonstrates.

Balanced focus on growth cannot be overemphasized in the success of sustainable design implementation. Without a) careful balance of Triple Bottom Line, b) balanced reliance on consumer insight, c) equal sustainability emphasis in brand portfolio, d) marketing dominance avoidance, e) economy of scale flexibility, and f) speed constraint flexibility, a NPD will be driven by pure profitability in the shortest time possible.

In addition, maturity of external contexts is another influencing factor and potential roadblock. No matter how hard the individual company strives to ensure the above factors in place internally, without the external context such as a) maturity of the target consumer or market, and b) maturity of infrastructure, the success of sustainable design implementation is limited.

To conclude, the framework attempts to explain which factors should precede to another, how some factors are reinforcing, and what factors can hinder the entire practice.

By a unique addition of knowledge, this model contributes to the current sustainable design or NPD front-end literature, which largely focuses on the rear-end of sustainable design implementation.

6.4 Addressing the gaps

This research addresses the three gaps in the knowledge that are identified in Section 1.2 (see Figure 6.4).

Gap I: Theory vs. Industrial practice

This research addresses the *gap between the wealth of sustainable design theory and a lack of industry practice*. Over the last couple of decades, numerous theoretical studies

have been conducted on sustainable design from both engineering design and industrial design research fields, but there is a lack of industry cases to back up the theories (Boks, 2006). Evidence from industry is hardly available except at a niche market or prototype level (Baumann *et al.*, 2002).

Figure 6.4 Addressed research gaps (based on Figure 1.1)

Hence this research conducts five industrial cases, and presents examples of sustainable design practice from each case. However, due to the short-lived nature of consumer goods, examples of sustainable design covering all three aspects of environment, society and economy are rare.

In light of this, case A and B provide a good example especially from the social perspective. They contract local farming communities in order to utilize the indigenous ingredients, and their traditional skin care remedies. This enables them to give back a certain ratio of the profit from this product line to the communities. In addition, bottles made with recycled plastic, switching from plastic bottles to thin plastic film bags, or minimalistic perfume bottles design without decorative caps are also good examples from the environmental perspective.

Case E practices sustainable design by using 50% recycled plastic in the bottle, providing user-friendly information on the packaging, reducing the transportation cost and carbon footprint in their ingredient supply chains. Environmental and social considerations are given to the ingredients as well as to the packaging. By suggesting these examples, the current research addresses Gap I.

Gap II: Theory vs. Research practice

This research covers the gap evident between prevalent emphasis of *the early adoption theory* and *the lack of sustainable design research in the front-end of NPD area*. In spite of countless academic claims that sustainable design consideration must be made at the early stage of the NPD process (Argument *et al*., 1998; Sherwin, 2000, Bhamra, 2004; Petala *et al*., 2010; Bocken *et al.,* 2014), little sustainable design research is available in conjunction with the rich body of NPD front-end research.

The current research actively explores the front-end of NPD to complement the early adoption theory from sustainable design research. The research questionnaires explicitly include the first three stages of NPD, in order to determine the sustainable design factors in the context of NPD. As a result, a considerable number of the NPD front-end factors turned out to share commonalities with sustainable design factors.

Gap II is addressed by the following observation: the identified factors are equally important as ***from*** the front-end as ***at*** the front-end. Unlike the initial assumption that once the factors are put into effect at the front-end the problems would be resolved, the factors that play important roles from the beginning also should be maintained throughout the process, except for technical factors, e.g. sustainability tools and champions.

Gap III: Reality vs. Absence of research

This research addresses the gap between *the unsustainable reality of FMCG practice* and *the absence of sustainable design research in the FMCG sector*. In spite of its direct anthropogenic impact on the environment and society, the FMCG sector is curiously unexplored from the sustainable design perspective. This may have hindered the FMCG companies in implementing more sustainability practice within their business activities. The grounds for this lack can be attributed partially to the difficulty in rigidly applying sustainable design into such short-lived products, as discussed earlier while addressing Gap I. This research scrutinizes this less-known industry and attempts to fill

in the gap as the first comprehensive study on sustainable design implementation within the FMCG sector.

6.5 Summary of discussion

Chapter 6 proposes the synthesis of research findings. Among a total of 11 factors and 32 elements presented in Table 6.1, nine factors and 19 elements confirm the literature findings, and two factors and 13 elements are newly identified.

Three groups of factors including *common sustainable design and front-end factors*, *sustainable design factors,* and *FMCG factor*s address Research Question 1 to 3, and the details of elements of each factor are highlighted. Research Question 4 is responded through the synthesis of quantitative data that draws out a discrepancy between perceived importance and reality in industry practice. Over 2/3 of cases reveals a higher expectation than their current execution of factors. Also, a pattern of stronger presence of factors is captured in higher SML companies.

A conceptual framework (Figure 6.3) is suggested to explain the interrelationships of factors. The framework points out that socio-psychological factors (e.g. senior management support, supportive corporate culture, individual attitude) should precede technical factors such as sustainability tools, sustainability champions and clear terminology. Also the framework shows that the FMCG factors can paly as a roadblock that hinders the sustainable design implementation.

The study addresses three research gaps. Gap I between the industrial practices is addressed by investigating the real world sustainable design practice. Gap II between theory and research practice is addressed by conducting an empirical study with a focus on the front-end of NPD process. Gap III between reality and the absence of research is addressed by conducting multiple case studies within the FMCG context.

Following chapter finalises this thesis with the summary of conclusion, contributions to knowledge, implications of knowledge, the future research opportunities, and author's final reflections.

7. Conclusions

This final chapter summarises the research findings, and sets out the contributions to knowledge, and the implications of knowledge. Also the opportunities for future research are identified. The final reflections bring this thesis to an end.

This research aims to increase understanding of the influencing factors for sustainable design implementation in the front-end of new product development (NPD) process within the fast-moving-consumer-goods (FMCG) sector.

To do so, this research investigates five FMCG companies across the world, and identified factors and elements relevant to implementation of sustainable design. An extensive literature review is conducted of the various fields related to sustainable design, which forms the base of constructing and selecting the relevant factors and elements. The commonalities and differences between sustainable design and NPD front-end research is studied by a cross-disciplinary approach. By dividing the subject companies into different sustainability maturation levels (SML), this research compares the relative importance and effect of the respective factors and elements. The conclusions of the research can be summarised as follows:

a) A total of 11 factors and 32 elements are identified to influence implementation of sustainable design in the front-end of NPD within the FMCG sector (see Table 7.1). Two Factors and 13 elements are newly found in this research (Highlighted in grey in Table 7.1).

b) Almost all of the relevant factors must be effective ***from*** the front-end not only ***at*** the front-end, and the consideration of the factors should be maintained throughout the entire NPD process.

Table 7.1 Influencing factors and elements for sustainable design at the front-end of NPD within FMCG (Repeated from Table 6.1)

COMMON SD &FRONT-END FACTORS	SUSTAINABILITY & FMCG elements
1. Senior Management support	a) Firm sustainability leadership
	b) Understanding of sustainability principles
	c) Rewarding individuals for sustainability achievement
2. Sustainability vision	a) Alignment with company's general vision
	b) Disseminated throughout company philosophy and daily activities
3. Internal communication	a) Healthy inter-personal relationship
	b) Variety of channels
4. Cross-functional team	a) Sustainability officer involvement
	b) Equal level engagement
5. Supportive corporate culture	a) Transparency
	b) Legacy
	c) Behaviour
	d) Belief
	e) Structure
	f) Citizenship
6. Individual attitude	a) Motivation based on the company's past sustainability practice
	b) Satisfaction about company's present sustainability practice
	c) Ambition about the company's future sustainability practice
SD FACTORS	**SUSTAINABILITY & FMCG elements**
7 Sustainability Champion	a) Official vs. voluntary
	b) Project level involvement
8. Sustainability tools	a) Customisation for company context
	b) Timely introduction
9. Clarity of terminology	a) Agreed definition on sustainability terminology
	b) Sense of sharing the same goal
FMCG FACTORS	**SUSTAINABILITY & FMCG elements**
10. Balanced focus on growth	a) Careful balance of Triple Bottom Line
	b) Balanced reliance on consumer insight
	c) Equal sustainability emphasis in brand portfolio
	d) Marketing dominance avoidance
	e) Economy of scale flexibility
	f) Speed constraint flexibility
11. Maturity of external contexts	a) Maturity of consumer / market
	b) Maturity of infra-structure

c) Among these factors, the FMCG sector is observed to require unique factors such as *balanced focus on growth* and *maturity of external contexts.* These two factors are not observed outside FMCG.

d) In companies more mature in terms of progress towards sustainability, the above identified factors have a stronger role and are present more often than less mature companies.

e) The influencing factors for sustainable design implementation are inter-related, and work in concert rather than having separate, discrete roles (Figure 7.1).

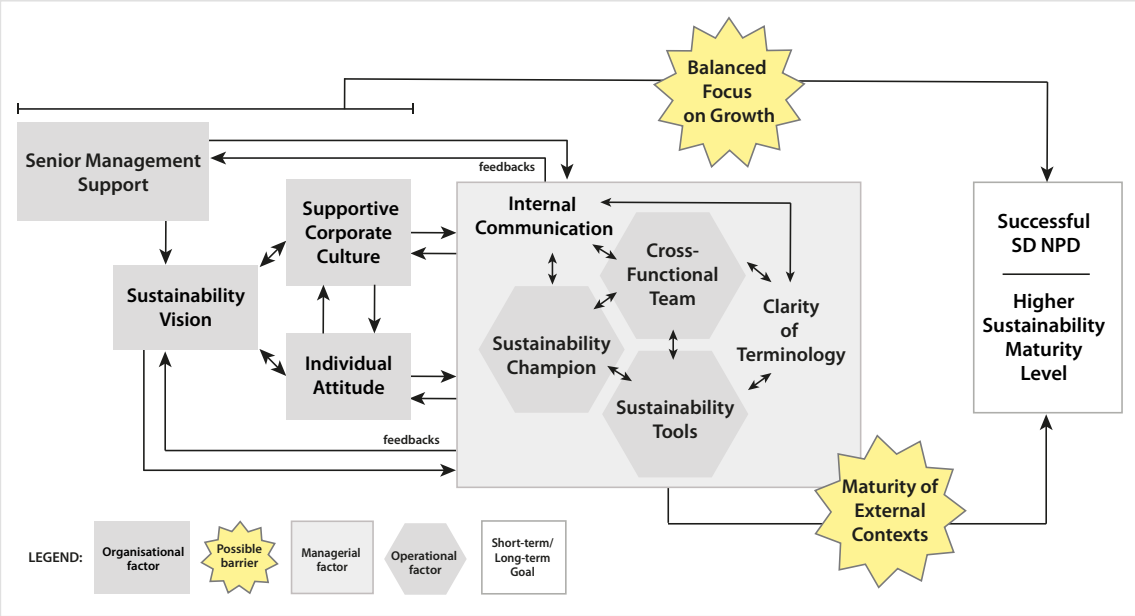


Figure 7.1 Framework of the interrelationships of influencing factors for sustainable design (SD) implementation in the front-end of NPD process within the FMCG sector (repeated from Figure 6.3)

f) Socio-psychological factors such as *corporate culture, individual attitude*, and *coherent sustainability vision* are seen to exert a strong, widespread impact on sustainability implementation when preceding technical or managerial factors.

g) A crucial part of successful implementation of sustainable design rely more on the commitment and accumulation of a long-term sustainability vision and strategy within a company, rather than the presence or absence of single factors.

h) The philosophical stance of a company such as how they set the ultimate purpose of business, and how they prioritise growth over other concerns affects the difference in the maturity level of sustainability.

7.1 Contributions to knowledge

This section discusses the contributions to knowledge of this research.

a) The empirical findings in this study assist our holistic understanding of the nature in promoting sustainable design implementation during the front-end of NPD for within the FMCG context. No previous research exists that provides substantive data and evidence directly from research activities with a specific focus on investigating a considerable number of FMCG companies.

b) The findings contribute to a body of literature by confirming 9 factors and 19 elements from the previous research findings, and newly adding two factors and 13 elements. The new factors are unique to the FMCG sector (see Table 7.1). To best of the researcher's knowledge, these two factors are not found previously within the FMCG context, and by doing so; this study enhances our understanding of *balanced focus on growth* factor, and *maturity of external contexts* factor within the FMCG industry.

c) The insights from this cross-disciplinary study complement two disparate research areas: sustainable design and front-end NPD studies. This study uncovered a substantial number of overlapping concepts from both areas, which would have not been possible to discover otherwise. This insight highlights the need of more cross-disciplinary research among seemingly disparate epistemic communities. As Coley (2008) points out, the process of sustainable design is complex, thus a holistic approach is imperative for a better understanding of its complicated nature.

d) The conceptual framework (see Figure 7.1) of the interrelationships of the influencing factors advances the way we think about problems. The framework unpacks the layers of the factors by an iterative thinking process of conversion and diversion, and derives deeper insight into the relationship between them.

7.2 Implications of knowledge

This section lists the courses of actions for senior managers, and designers in FMCGs.

a) This research will serve as guidance for the FMCG practitioners at the managerial level in the purpose of initiating more systematic sustainable design implementation schemes in the long-term. Senior managers are expected to use this research in diagnosing the status quo, and make decisions for the future direction.

b) In-house designers in the FMCG sector can gain an understanding through the framework (see Figure 7.1) when they strive to adopt sustainable design to the NPD process. Particularly, the factors and the elements can provide concrete tips about where to start and what to look for. Also, the framework can help

them communicate better with senior managers, when the bottom-up approach is blocked go any further from the designer level.

7.3 Opportunities for further research

This section recommends a number of further research opportunities that will address the gaps in the present research.

First, this study may be extended to several applications in various FMCG companies in different locations. Although the sample cases of the present research are located in three different continents including Eastern Europe, Far East Asia and South America, such additional research would be helpful to strengthen the universal and cross-cultural validity of the factors and elements for sustainable design implementation during the NPD process, and would provide richer insight about varying implications in different geographical / national contexts.

Another further research opportunity could be a longitudinal study that tests the proposed factors and elements over a certain period of time. The present research successfully captures the present states of sustainable design implementation in each case based on their latest NPD projects that has already been completed. While this is legitimate within the given timeframe, and appropriate for the initial investigation, a longitudinal study that covers the entire NPD process, which can take a minimum of six months, may provide further information on how subsequent or even later developmental stages can affect the implementation activities. An NPD process neither stands alone, nor does it occur overnight. The manifestation of the factors and elements in future NPD can be variable depending on the conditions, experience, and dynamics surrounding the stage in question.

Third, the inter-relationships between the factors and barriers suggested in the framework need further empirical examination against real-life industry conditions.

The conceptual framework suggested in this research is provided to aid comprehension of how all the factors interact with one another in the NPD process context, which requires validation by future studies. In this regard, future studies may benefit by developing a consistent metrics to measure how the factors interplay, and how that influences the front-end stages.

Fourth, in order to spread the research results more efficiently to the target audience, the next generation of this study could develop the framework into a dissemination tool. Although the dissemination of research results is normally left at the hand of practitioners, dissemination itself is an established research area with sophisticated methods and theories. Dissemination is defined as a "planned process that involves consideration of target audiences and the settings in which research findings are to be received, and where appropriate, communicating in ways that will facilitate research uptake in decision-making processes and practice" (Wilson, 2010). Diffusion, dissemination and implementation theories such as Rogers's classic 'diffusion of innovations (DOI)' (1963, 2003) and following studies (e.g. Dobbins, et al., 2002; Greeenhalph *et al.,* 2004; Tabak *et al.,* 2012) are proposed as reference points. DOI is a classical theory dating back to 1963 coined by Rogers that proposes the actors and stages when social change occurs. Additionally, though originally developed within the public health sector, Greenhalph *et al.* (2004)'s systematic review of 13 independent research areas relevant to diffusion of innovations tactfully summarises the findings on the attributes of innovations, characteristics and extent of dissemination terminologies, making it is worthwhile to be taken into account for sustainability dissemination within an industry context. Also Tabak *et al.* (2012) produces a useful investigation into divergent levels and implication of dissemination.

Fifth, a further in-depth study with regard to clarity of sustainable design terminology is recommended in conjunction with epistemology / ontology studies. The present research confirms the gaps in sustainable design terminology knowledge between the academic, industrial practitioners, and consumers. Future research may investigate a fundamental understanding of lexicons; seek for an efficient approach to eliminate the

gaps; and clarify the role of clearer terminology for better communication within a company, and between company and consumers, respectively.

7.4 Final reflections

In May 2014, the international charity Oxfam published a report that indicates the World's biggest 10 food and drinks FMCG brands together emit more greenhouse gases than all five Scandinavian countries' total annual emission: 250 million tons (Oxfam, 2014). Whilst greenhouse gas is only a slice of diverse aspects of sustainability, this is striking on top of a lack of sustainability research within the FMCG sector. The pressing need for immediate action to revolutionise the business-as-usual of FMCG into sustainable practice cannot be overemphasised.

This research started from the author's personal aspiration to lead a creative yet responsible life as a product designer-cum-consumer. A good number of designers around the world have been striving to produce sustainable solutions by design. The author also had been eager to pursue sustainability in most of her design projects. Nevertheless, the question 'why on earth can we hardly find sustainable design options in our everyday consumption?' has remained unanswered, and so did this research commence with a focus on the sustainable design process within the Fast-Moving-Consumer-Goods sector.

Whereas many of consumer goods (i.e. FMCG products) are essential in our daily lives, the very nature of 'being fast (in manufacturing, distributing and consuming)' of the FMCG sector makes it tricky to implement sustainability practice. However this cannot justify today's blind mass manufacturing, aggressive promotion of consumerism, and the half-way-though sustainability practices. Can one avoid the 'green-washing' label if their sustainability attempt is partial? No, ostensible sustainability cannot truly lead the world to be more sustainable. In this sense, it was such an awe-inspiring

experience to visit the excellent exemplary FMCGs, and witness their wholesome commitment to sustainability throughout the company practices. So it's not a mission impossible.

All in all, the outcomes of this research are nothing but common sense. Having provided the empirical evidence to back up common sense, this research reassures how it is so uncommon to see common sense in place in the real world. Certainly countless things out there are not being done as it should be. How many visionaries have warned about the harms of business-as-usual?

We all are the part of causes and consequences of today's environmental crisis; only we do not witness the consequence as instant as using a vending machine. Nonetheless, we lead one's life as if we will live forever, and we run business as if the nature will endure us forever. This research helps the business-as-usual FMCGs adopt more sustainability-conscious attitude toward their business, and embrace the challenges and changes the adoption would entail.

Another amusing discovery of common sense out of place was that two separate research bodies are unknowingly talking about same things. The renowned socio-biologist Wilson (1999) advocates *consilience*, the fundamental unity of knowledge, may provide the blueprint of our world, for it is the fragmentation and specialization that has gradually led the body of knowledge into a 'misty labyrinth'. This research hopes to have made a sensible attempt of bringing different epistemic communities together for better understanding of the world. The results give guidance to those who are striving to understand the complex world of sustainable design and business, and plunge themselves into a deeper investigation.

This research ultimately hopes to bring back common sense in place, and provide a fresh inspiration for the current FMCG industry to fulfil their responsibilities for consumers, society and the environment. When consumers can find many more sustainable design options on the shelf, it would help us to be more gentle and kind to nature and each other.

The Birth of Song

I am as certain of my song,
  When first it warms my brain,
As woman of her unborn child,
  Or wind that carries rain.
The child and rain are born at last,
  Though now concealed from sight-
So let my song, unshaped and crude,
  Come perfect to the light.

W.H. Davies (1871-1940)

8. References

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9. Appendices

Appendix A. Various definitions of environmentally focused design terms

TERMS	AUTHOR(S)	DEFINITIONS CONCEPTS
GREEN DESIGN	US office of Technology Assessment, van WEENEN, (1995)	Two general goals 1) Waste **prevention**: activities of manufacturers and consumers that avoid the generation of waste. (e.g. using less material to perform the same function, designing durable products) 2) **Better** material management: activities that allow product components or materials to be recovered and reused in their highest value-added application (e.g. readily disassembled into constituent materials, easy recyclable materials without the separation process) `
	Dewberry and Goggins, (1996)	Single issue focus Use of resources or nature of resources or process i.e. Energy efficiency, using recycled materials, clean technology
ECO DESIGN	Ecological Design Association (EDA), (1990)	The design of materials and products, projects and systems environments communities which are friendly to living species and planetary ecology.
	Eco2-IRN Research Group, (1994)	Design which addresses all environmental impacts of a product, without unduly compromising other criteria like function, quality, cost and appearance.
	van WEENEN, (1995)	More emphasis on product development instead of on product design The object: to formulate improved or **new development processes**, and at the same time set good examples of novel products with clear environmental characteristics.
	Dewberry and Goggins, (1996)	Lifecycle principle / all environmental fields Incorporates green design best practice More from less/optimum life strategies Appropriate quality

	i.e. Upgradability, modularity, cascading, reuse and repair	
Brezet and van Hemel, (1997)	The environment helps to define the direction of design decisions and the environment becomes a co-pilot in product development	Considers environmental aspects at all stages of the product development process, striving for products, which make the lowest possible environmental impact throughout the product life cycle... eco design, should leas to more sustainable production and consumption.
Simon *et al*. (1998)	The design of a product, system or service with the aim of minimising the overall impact on the environment. A broader term than DfE, implying a balanced view of the whole product life cycle and design effort focused on reducing the major environmental impacts for designers concentrate on the end of the product life cycle. Eco design is equally concerned with issues such as the 'embodied' environmental burden of the materials, the energy used by a product and its toxic emissions.	
Sherwin and Evans (1998, 2000)	The design of a product, service or system with the aim of minimising the overall impact on the environment	
Lewis *et al*., (2001)	Designing products with the environment in mind and to assume some responsibility for the product's environmental consequences as they relate to specific decisions and actions executed during the design process	
Charter and Tischner (2001)	Sustainable solutions are products, services, hybrids or system changes that minimize negative and maximize positive sustainability impacts economic, environmental, social and ethical throughout and beyond the life cycle of existing products or solutions, while fulfilling acceptable societal demands/needs	
Johansson, (2002)	Actions taken in product development aimed at minimising a product's environmental impact during its whole life cycle, without compromising other essential product criteria such as performance and cost.	
Bhamra, (2004)	One **strategy** being employed to move towards a more sustainable future. It is understood to be the systematic integration of environmental considerations into the design process across the product life cycle, from cradle to grave.	

	European Commission (2005)	The integration of environmental aspects into product design with the aim of improving the environmental performance [of the product] throughout its whole life cycle.	
	Karlsson and Luttropp, (2006)	Focuses on the integration of environmental considerations in product development.	
	Park and Tahara, (2008)	An activity that identifies the environmental aspects of a product and then integrates them into the product design process in the early stage of the product development process	
	Spangenberg *et al*. (2010)	Eco design is an approach dealing mainly with environmental and economic effects (and thus with eco-efficiency), based on a LCA of cost and impacts.	
ENVIRONMENT -ALLY CONSCIOUS DESIGN	Argument *et al*. (1998)	The same definition applied as eco design	
	O'Hare, (2010)	ECD is an umbrella term for DfE, eco design and eco-innovation	
SUSTAINABLE DESIGN	Dewberry and Goggin, (1994)	The concept of sustainable design is much more complex than eco design and moves the interface of design outwards toward societal conditions, development, and ethics.	
		Incorporates eco design best practice Questions / address needs- reduced resource throughput Concern for ethics and equity- long term vision Services and leasing rather than products and ownership i.e. Dematerialisation, systems, empowerment, caring, sharing	
	ECO2 group, (1994)	Sustainable design is system-based and long-term.	
	Madge, (1997)	"Analysing and changing the 'systems' in which we make, use, and dispose of products" as opposed to	Sustainable' has become the buzzwords of the 90s in the same way 'green' was in the 80s. It is equally open to different interpretations and misuse.

		more limited, short-termed DfE.	
	Charter and Chick, (1997)	The key aspect of 'sustainable product design (SPD)' is the addition and balancing of social and ethical issues, alongside environmental and economic issues into the product design process- to achieve 'the quadruple bottom-line'	
	Simon *et al*. (1998)	The over-riding concepts towards which eco design contributes.	
	Bahmra and Lofthouse, (2007)	Sustainable design takes into account environmental, economic and social impacts enacted throughout the product lifecycle	Often referred to as triple bottom line of sustainability (Elkington, 1997)
	Short *et al*. (2012)	Sustainable design clearly should go **far beyond eco design**, into social and economic aspects.	
DESIGN FOR X	Maxwell and van der Vorst, (2003)	Design for X approaches have subsets focused on specific areas, e.g. disassembly, recycling, etc. All focus to different extents on identifying and reducing or, eliminating the environmental impacts of a product throughout its life cycle.	
	Kurk and Eagan, (2008)	X can stand for recyclability or manufacturability or durability.	
DfE **(Design for Environment)**	Lenox *et al*. (1996)	The **systematic process** by which firms design products and processes in an environmentally conscious way	
	Birkhofer and Schotts (1996)	An **optimisation process** with the goal of minimising the detrimental impact of the product on the environment throughout its life cycle.	
	Simon *et al*. (1998)	Although almost interchangeable with eco design, DfE is sub-set of eco design and implicitly associated with concerns such as Design for Disassembly and recycling.	
	Ljungberg, (2007)	DfE can be seen as a broad and general concept for promoting sustainable design. Soe examples of common strategies are	

		Modular design
		Design for material substitution
		Waste source reduction design
		Design for Disassembly
		Design for Recycling
		Design for Disposability
		Design for Reusability
		Design for Service
		Design for Substance Reduction
		Design for Energy Recovery
		Design for Life Extension
	Kurk and Eagan, (2008)	While pollution prevention or cleaner production has traditionally focused on company internal processes in practice, DfE's life cycle perspective offers an broader opportunity to generate environmental and economic benefits.
		DfE and LCA have many similarities such as focusing on the development of cleaner products, and applying the life cycle perspective. However, in contrast to LCA, DfE tools can be **integrated at an earlier phase** of the product development.
		DfE is for incremental environmental improvements.
		DfE programme can reduce manufacturing cycle times, distinguish products, and provide a competitive advantage in markets valuing environmental attributes.
		DfE provides an environmental perspective that can drive innovation.
DESIGN FOR SUSTAIN-ABILITY	Kurk and Eagan, (2008)	Design for Sustainability is **more comprehensive** design improvements than DfE, adding social and economic issues to DfE.
	Manzini, (2009)	Everything design can do to facilitate the social learning process towards a sustainable society. That is to sustain promising social and technological innovations and to reorient existing drivers of change towards sustainability.
	Spangenberg *et al*. (2010)	Design for Sustainability approach is **transformationa**l gains through a **precautionary** approach

	Technical and social innovations
	Questions the existence of the object itself
	Seeks to re-discover other methods of satisfying the needs addressed
	Assessment of long-term and global impacts based on the four dimensions of sustainable development for all stages in the life cycle of a product or service.
	As opposed to eco design, DfS addresses all dimensions of sustainability, looking at **bigger systems** and asking more **fundamental questions** about consumption and production. It plays its most important role in combining the effects of satisfier efficiency with the supply and product 'efficiencies'.
	It must offer an alternative, providing sustainable satisfiers and improving satisfaction effectiveness.

Appendix B Various definitions of system terminologies

TERMINOLOGY	EXEMPLAR	
Model	**Dictionary definition:** A physical representation that shows what it looks like or how it works. The model is often smaller than the object it represents.	
	Kaplan, R. S. (1986)	**Definition:** Scientific metaphors (Kaplan, 1964)
		Characteristics: Two important functions Data organization: conscious, explicit, definite Cognitive styles: provides valuable materials for scientific treatment
		Limitations Overemphasis on symbols Overemphasis on form Oversimplifications Overemphasis on rigor Map reading Pictorial realism
	Meredith, J. (1992)	**Definition:** Simplified representation or abstraction of reality (Turban and Meredith, 1991)
		Conceptual model: A set of concepts, with or without propositions, used to represent or describe (but not explain) an event, objects, or process.
		Characteristics: Describes, reflects or replicates a real event, object, or process but does **not "explain**" (Zaltman, Lemasters and Heffring, 1982).
		Sub-categories Iconic models: the least abstract. The physical replicas of a system or situation e.g.) scale model of a bridge, a photograph, a tinker-toy version of a molecule Analogue models: The next level of abstract, does not physically look like the original system but behave like the relevant portion of it e.g.) an organization chart, a colour map, the blueprint of a house, an hourglass **Symbolic models**: The most abstract, allows the greatest manipulation for purposes of analysis e.g.) mathmatical equations, Monte Carlo sochastic simulations
		Conceptual description: Primarily descriptive in its modeling of an event or phenomenon: can be highly simplified or extensive. Does not explain why things happen; just that these are the relevant concepts (elements) and propositions which describe the phenomenon Taxonomies and typologies: Taxonomies: listing of items along a continuous scale. The items may be classified under different headings and subheadings but they all have a relative position on the continuum which allows them ti be ranked in order. Typologies: **two- or higher-dimensional taxonomies**. The classification does not explain the relationships but simply describes the situation more accurately than other descriptions. 1) Philosophical conceptualization: Integrates a number of different works on the same topic, summarizes the common elements, contrasts the differences, and extends the work in some fashion.
Frameworks	**Dictionary definition:** A particular set of rules, ideas, or beliefs, which you use in order to	

	deal with problems or to decide what to do.	
	Meredith, J. (1992)	**Definition of conceptual framework**: A collection of two or more interrelated propositions which **explain an event**, provide understanding, or suggest testable hypotheses (Naumann, 1984)
		Characteristics: Includes **epistemic propositions or explanatory elements**, yet does not fulfill all five of the requirements: essentially a **pre-theory** and may substitute in many ways for a theory
		- Conceptual induction: A number of occurrences of a phenomenon as analysed to infer the nature of the system or treatment which produce them to explain a phenomenon through the relationships observed between the system's elements - Conceptual deduction: Its ramifications are detailed for comparison with reality - Conceptual systems: consists of multiple concepts with many interrelated propositions
Theory	**Dictionary definition:** A formal idea or set of ideas that is intended to explain something	
	Meredith, J. (1992)	**Definition**: A coherent group of interrelated concepts and propositions used as principles of explanation and understanding
		Requirement: 1) Allows prediction or increased understanding is interesting (i.e. non-trivial) 2) Includes attributes or variables and their interactions 3) Does not include 'composite' variables 4) Includes boundary criteria (Dubin, 1969)
Process	**Dictionary definition:** A series of actions which are carried out in order to achieve a particular result.	
	Langley, A. (1999)	**Characteristics:** Deals with **sequences of "events, activities, and choices ordered over time**" - Involve multiple levels and units of analysis - Temporal embeddedness often varies in terms of precision, duration, and relevance - Eclectic drawing in phenomena such as changing relationships, thoughts, feelings, and interpretations
		Requirement: Understanding how things evolves **over time** and why they evolve in this way - **Understanding patterns in events is the key**
Concept	**Dictionary definition:** An idea or abstract principle	
	Zaltman, Lemasters and Heffring (1982) Emory, C.W. (1985)	**Definition:** A bundle of meanings or characteristics associated with certain events, objects, or conditions and used for representation, identification, communication, or understanding

Appendix C. In-depth questionnaire: Data collection Phase 1

No.

Research Questionnaire

Distinctive Success Factors for Sustainable Design Implementation in the New Product Development Process

Personal Information

Name:_____ Date:_____

Company Name:_____ Department:_____

Job Title:_____ Parent / Division:_____

Experience in this job (in years):_____ Email address:_____

The survey process may be audio-recorded with your permission for transcription purpose only. You and your company will remain anonymous. The collected data will be used for a doctoral research project and related academic journal publication only.

EXAMPLE 1

(X) PLEASE INDICATE THE USAGE OF FOLLOWING TERMS WITHIN YOUR NPD ACTIVITIES BY DIFFERENT STAKEHOLDERS (Write the number in the square):

SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS

	Stage 0	Stage 1	Stage 2	Gate
(A) Member Of Senior Management Team	4	2	1	5

EXAMPLE 2

(X) PLEASE INDICATE THE IMPORTANCE OF CROSS-FUNCTIONALITY OF TEAMS IN ACHIEVING SUCCESS WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

SCALE: 1 = NOT IMPORTANT AT ALL, 3 = NEUTRAL, 5 = VERY IMPORTANT

(A)	Stage 0 Discovery	: Idea generation	1 2 3 4 **5**
	Gate1		
(B-1)	Stage 1 Scoping	: Preliminary assessment of market	1 2 **3** 4 5
(B-2)		: Preliminary assessment of technology	**1** 2 3 4 5
	Gate2		
(C-1)	Stage 2 Business Case Building	: Define product concepts	1 2 3 **4** 5
(C-2)		: Define design requirements & specifications	1 2 **3** 4 5
(D-1)		: Evaluate outcomes	1 2 3 4 **5**
(D-2)	Gate	: make decision to go further	1 **2** 3 4 5

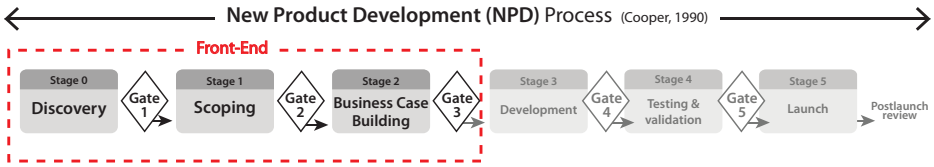
I

RESEARCH OVERVIEW

This questionnaire aims to collect industry data that can help identify distinctive success factors that contribute to successful development of more sustainable products in the Front-End stages of the New Product Development (NPD) process (Cooper, 1990). The research context is within the Fast-Moving-Consumer-Goods (FMCG) sector.

The purpose of section 1 is to confirm common factors that attribute to successful NPD.
The purpose of section 2 is to identify specific factors for successful implementation of sustainable design.

The research questionnaire is formulated based on the Stage-Gate model of NPD process. The specific focus is on the front-end stages of the NPD process: Stage 0, 1, and 2, as the early consideration of sustainable design is critical to the success or failure of sustainable design products (Poole and Simon, 1997; Argument, et al., 1998; MacMillan, et al., 2001; Bhamra, 2004; Sandstrom and Tingstrom, 2008).



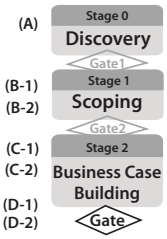
SECTION 1: COMMON NPD SUCCESS FACTORS

- **SECTION 1 AIMS TO CONFIRM COMMON SUCCESS FACTORS THAT ATTRIBUTE TO SUCCESSFUL NPD.**

A. CONSUMER INVOLVEMENT

1.A.1 PLEASE INDICATE THE IMPORTANCE OF CONSUMER INVOLVEMENT IN ACHIEVING SUCCESS WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

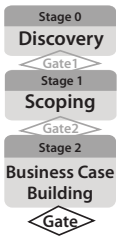
SCALE: 1 = NOT IMPORTANT AT ALL, 3 = NEUTRAL, 5 = VERY IMPORTANT



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

1.A.2 PLEASE INDICATE THE FREQUENCY OF CONSUMER INVOLVEMENT WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

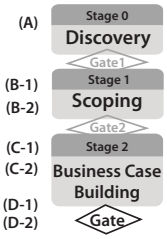
SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

1.A.3 PLEASE INDICATE THE EFFECTIVENESS OF CONSUMER INVOLVEMENT WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

Scale: 1 = NOT EFECTIVE AT ALL, 3 = NEUTRAL, 5 = VERY EFFECTIVE



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

1.A.4 PLEASE INDICATE THE <u>FREQUENCY</u> OF CONSUMER INVOLVEMENT WITHIN THE FRONT-END NPD ACTIVITIES (Write a number in the square):

SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS

	Stage 0	Stage 1	Stage 2	Gate
(A)End Users	■	■	■	■
(B) Purchasers	□	□	□	□
(C) Retailers	■	■	■	■
(D) Other (Please specify:)	□	□	□	□

1.A.5 PLEASE INDICATE THE <u>VALUE</u> OF CONSUMER INVOLEMENT IN ACHIEVING SUCCESS IN YOUR NPD ACTIVITIES (Write a number in the square):

	Scale: 1 = NO, 3 = NEUTRAL, 5 = HIGH	FREQUENCY
(A) Identifying real consumer needs & wants	1 2 3 4 5	□
(B) Reducing NPD time	1 2 3 4 5	□
(C) Developing healthy pipeline with consumers	1 2 3 4 5	□
(D) Reducing market uncertainty	1 2 3 4 5	□
(E) Other (Please specify:)	1 2 3 4 5	□

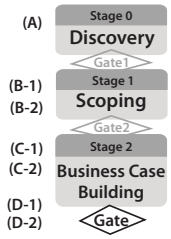
1.A.6 HOW WOULD YOU <u>DEFINE SUCCESS</u> IN RELATION TO CONSUMER INVOLVEMENT?

EXMAPLE?

B. SENIOR MANAGEMENT SUPPORT

1.B.1 PLEASE INDICATE THE <u>IMPORTANCE</u> OF SENIOR MANAGEMENT SUPPORT IN ACHIEVING SUCCESS WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

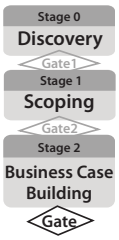
SCALE: 1 = NOT IMPORTANT AT ALL, 3 = NEUTRAL, 5 = VERY IMPORTANT



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

1.B.2 PLEASE INDICATE THE <u>FREQUENCY</u> OF SENIOR MANAGEMENT SUPPORT WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

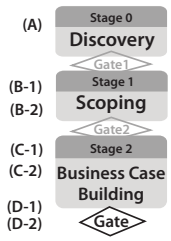
SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

1.B.3 PLEASE INDICATE THE <u>EFFECTIVENESS</u> OF SENIOR MANAGEMENT SUPPORT WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

Scale: 1 = NOT EFECTIVE AT ALL, 3 = NEUTRAL, 5 = VERY EFFECTIVE



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

1.B.4 PLEASE INDICATE WHICH SENIOR MANAGEMENT MEMBERS ARE TYPICALLY INVOLVED WITHIN THE FRONT-END NPD ACTIVITIES (Write a number in the square):

SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS

	Stage 0	Stage 1	Stage 2	Gate
(A) CEO / Managing Director	■	■	■	■
(B) Marketing Manager	□	□	□	□
(C) Engineering / Manufacturing Manager	■	■	■	■
(D) R&D Manager	□	□	□	□
(E) CSR (Corporate Social Responsibility) Manager	■	■	■	■
(F) Corporate Sustainability Manager	□	□	□	□
(G) Design Manager	■	■	■	■
(H) Brand Manager	□	□	□	□
(I) Supply Chain Manager	■	■	■	■
(J) Other (Please specify:)	□	□	□	□

1.B.5 PLEASE INDICATE THE <u>VALUE</u> OF SENIOR MANAGEMENT SUPPORT IN ACHIEVING SUCCESS IN YOUR NPD ACTIVITIES (Write a number in the square):

	Scale: 1 = NO, 3 = NEUTRAL, 5 = HIGH					FREQUENCY
(A) Providing Finance	1	2	3	4	5	□
(B) Providing Clear Vision	1	2	3	4	5	□
(C) Providing Sustainability Guideline	1	2	3	4	5	□
(D) Top-Down Pressure On Sustainability	1	2	3	4	5	□
(E) Rewarding Individual Incentive On Sustainability Achievement	1	2	3	4	5	□
(F) Other (Please specify:)	1	2	3	4	5	□

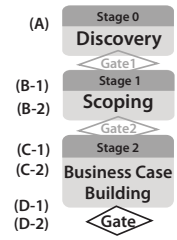
1.B.6. HOW WOULD YOU <u>DEFINE SUCCESS</u> IN RELATION TO SENIOR MANAGEMENT SUPPORT?

EXAMPLE?

C. INTERNAL COMMUNICATION

1.C.1 PLEASE INDICATE THE IMPORTANCE OF EFFECTIVE INTERNAL COMMUNICATION IN ACHIEVING SUCCESS WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

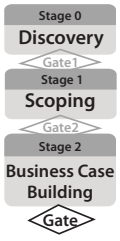
SCALE: 1 = NOT IMPORTANT AT ALL, 3 = NEUTRAL, 5 = VERY IMPORTANT



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

1.C.2 PLEASE INDICATE THE FREQUENCY OF INTERNAL COMMUNICATION WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

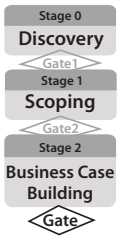
SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

1.C.3 PLEASE INDICATE THE EFFECTIVENESS OF INTERNAL COMMUNICATION WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

Scale: 1 = NOT EFECTIVE AT ALL, 3 = NEUTRAL, 5 = VERY EFFECTIVE



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

1.C.4 PLEASE INDICATE WHO TYPICALLY INVOLVED IN THE INTERNAL COMMUNICATION WITHIN YOUR FRONT-END NPD ACTIVITIES (Write a number in the square):

SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS

	Stage 0	Stage 1	Stage 2	Gate
(A) Member Of Senior Management Team				
(B) Marketing Manager				
(C) Marketing Personnel				
(D) Engineering / Manufacturing Manager				
(E) Engineering / Manufacturing Personnel				
(F) R&D Manager				
(G) R&D Personnel				
(H) CSR (Corporate Social Responsibility) Manager				
(I) CSR (Corporate Social Responsibility) Personnel				
(J) Corporate Sustainability Manager				
(K) Corporate Sustainability Personnel				
(L) Design Manager				
(M) Designer				
(N) Brand Manager				
(O) Brand Personnel				
(P) Supply Chain Manager				
(Q) Supply Chain Personnel				
(R) End-Users (consumers)				
(S) Other (Please specify:)				

1.C.5 PLEASE INDICATE THE VALUE OF EFFECTIVE INTERNAL COMMUNICATION IN ACHIEVING SUCCESS IN YOUR NPD ACTIVITIES (Write a number in the square):

Scale: 1 = NO, 3 = NEUTRAL, 5 = HIGH

		FREQUENCY
(A) Building Team Cohesion	1 2 3 4 5	
(B) Reducing Misunderstandings & Barriers to Interact	1 2 3 4 5	
(C) Sharing Same Visions and Goals	1 2 3 4 5	
(D) Understanding Other Functions Priority	1 2 3 4 5	
(E) Other (Please specify:)	1 2 3 4 5	

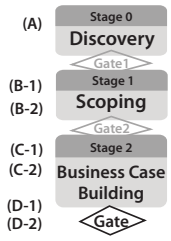
1.C.6 HOW WOULD YOU DEFINE SUCCESSFUL EFFECTIVE INTERNAL COMMUNICATION?

EXAMPLE?

D. CROSS-FUNCTIONAL TEAM

1.D.1. PLEASE INDICATE THE IMPORTANCE OF CROSS-FUNCTIONALITY OF TEAMS IN ACHIEVING SUCCESS WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

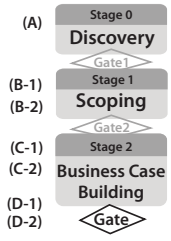
SCALE: 1 = NOT IMPORTANT AT ALL, 3 = NEUTRAL, 5 = VERY IMPORTANT



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

1.D.2. PLEASE INDICATE THE FREQUENCY OF CROSS-FUNCTIONAL TEAM INVOLVEMENT WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

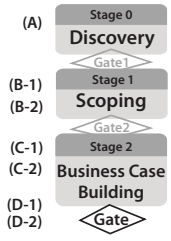
SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

1.D.3 PLEASE INDICATE THE EFFECTIVENESS OF CROSS-FUNCTIONAL TEAMS WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

Scale: 1 = NOT EFECTIVE AT ALL, 3 = NEUTRAL, 5 = VERY EFFECTIVE



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

1.D.4 PLEASE INDICATE WHO TYPICALLY INVOLVED WITHIN IN THE FRONT- END NPD ACTIVITIES (Write a number in the square):

SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS

	Stage 0	Stage 1	Stage 2	Gate
(A) Member Of Senior Management Team	■	■	■	■
(B) Marketing Manager	□	□	□	□
(C) Marketing Personnel	■	■	■	■
(D) Engineering / Manufacturing Manager	□	□	□	□
(E) Engineering / Manufacturing Personnel	■	■	■	■
(F) R&D Manager	□	□	□	□
(G) R&D Personnel	■	■	■	■
(H) CSR (Corporate Social Responsibility) Manager	□	□	□	□
(I) CSR (Corporate Social Responsibility) Personnel	■	■	■	■
(J) Corporate Sustainability Manager	□	□	□	□
(K) Corporate Sustainability Personnel	■	■	■	■
(L) Design Manager	□	□	□	□
(M) Designer	■	■	■	■
(N) Brand Manager	□	□	□	□
(O) Brand Personnel	■	■	■	■
(P) Supply Chain Manager	□	□	□	□
(Q) Supply Chain Personnel	■	■	■	■
(R) End-Users (consumers)	□	□	□	□
(S) Other (Please specify:)	■	■	■	■

1.D.5 PLEASE INDICATE THE <u>VALUE</u> OF CROSS-FUNCTIONAL TEAM IN ACHIEVING SUCCESS IN YOUR NPD ACTIVITIES (Write a number in the square):

Scale: 1 = NO, 3 = NEUTRAL, 5 = HIGH

						FREQUENCY
(A) Bringing in Different Expertise	1	2	3	4	5	□
(B) Including Sustainability Consideration from the Beginning	1	2	3	4	5	□
(C) Sharing Same Visions and Goals	1	2	3	4	5	□
(D) Understanding Other Functions Priority	1	2	3	4	5	□
(E) Other (Please specify:)	1	2	3	4	5	□

1.D.6 HOW WOULD YOU <u>DEFINE SUCCESS</u> IN RELATION TO CROSS-FUNCTIONAL TEAM?

EXAMPLE?

SECTION 2: SUSTAINABLE DESIGN KEY FACTORS

• **SECTION 2 AIMS TO IDENTIFY SPECIFIC SUCCESS FACTORS FOR IMPLEMENTING SUSTAINABLE DESIGN.**

A. COMMON USE OF LANGUAGE

2.A.1. PLEASE INDICATE THE USAGE OF FOLLOWING TERMS WITHIN YOUR NPD ACTIVITIES BY DIFFERENT STAKEHOLDERS (Write a number in the square):

SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS

	By You	By Your Team Members	By Your Manager	By Your Company	By Your consumers
(A) Green Design	☐	☐	☐	☐	☐
(B) Eco Design	☐	☐	☐	☐	☐
(C) Design for the Environment	☐	☐	☐	☐	☐
(D) Environmental conscious Design	☐	☐	☐	☐	☐
(E) Sustainable Design	☐	☐	☐	☐	☐
(F) Other (Please specify:)	☐	☐	☐	☐	☐

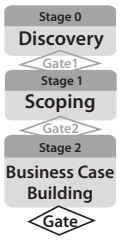
2.A.2 PLEASE INDICATE THE IMPORTANCE OF USING COMMON SUSTAINABLE DESIGN TERM IN ACHIEVING SUCCESS WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

SCALE: 1 = NOT IMPORTANT AT ALL, 3 = NEUTRAL, 5 = VERY IMPORTANT

(A)	Stage 0 Discovery	: Idea generation	1	2	3	4	5
	Gate1						
(B-1)	Stage 1 Scoping	: Preliminary assessment of market	1	2	3	4	5
(B-2)		: Preliminary assessment of technology	1	2	3	4	5
	Gate2						
(C-1)	Stage 2 Business Case Building	: Define product concepts	1	2	3	4	5
(C-2)		: Define design requirements & specifications	1	2	3	4	5
(D-1)		: Evaluate outcomes	1	2	3	4	5
(D-2)	Gate	: Agree / disagree to go to the next stage	1	2	3	4	5

2.A.3 PLEASE INDICATE THE EFFECTIVENESS OF USING COMMON SUSTAINABLE DESIGN TERM WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

Scale: 1 = NOT EFECTIVE AT ALL, 3 = NEUTRAL, 5 = VERY EFFECTIVE



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

2.A.4 PLEASE INDICATE THE VALUE OF COMMON USE OF LANGUAGE IN ACHIEVING SUCCESS IN YOUR NPD ACTIVITIES (Write a number in the square):

Scale: 1 = NO, 3 = NEUTRAL, 5 = HIGH FREQUENCY

(A)	Common Understanding between Individuals	1	2	3	4	5	☐
(B)	Common Understanding between Teams	1	2	3	4	5	☐
(C)	Common Understanding between Functions	1	2	3	4	5	☐
(D)	Reducing confusion during internal communication	1	2	3	4	5	☐
(E)	Other (Please specify:)	1	2	3	4	5	☐

2.A.5 HOW WOULD YOU DEFINE SUCCEESS IN REALTION TO COMMON USE OF LANGUAGE?

EXAMPLE?

B. SUSTAINABILITY CHAMPION

2.B.0 DO YOU HAVE A SUSTAINABILITY CHAMPION IN YOUR COMPANY?

☐ **YES** -> please continue to 2.B.1 ☐ **NO** -> please go to PART C.

* Sustainability champion (or environmental champion/ coordinator/ advisor) is a person who is in charge of helping and encouraging sustainability consideration into design within company or projects. (McAloone, 1998; Pujari, et al., 2003).

2.B.1 PLEASE INDICATE THE IMPORTANCE OF HAVING A SUSTAINABILITY CHAMPION IN ACHIEVING SUCCESS WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

SCALE: 1 = NOT IMPORTANT AT ALL, 3 = NEUTRAL, 5 = VERY IMPORTANT

(A)	Stage 0 Discovery	: Idea generation	1	2	3	4	5
	Gate1						
(B-1)	Stage 1 Scoping	: Preliminary assessment of market	1	2	3	4	5
(B-2)		: Preliminary assessment of technology	1	2	3	4	5
	Gate2						
(C-1)	Stage 2 Business Case Building	: Define product concepts	1	2	3	4	5
(C-2)		: Define design requirements & specifications	1	2	3	4	5
(D-1)		: Evaluate outcomes	1	2	3	4	5
(D-2)	Gate	: Agree / disagree to go to the next stage	1	2	3	4	5

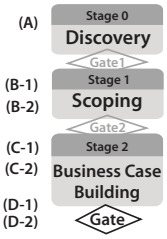
2.B.2 PLEASE INDICATE THE FREQUENCY OF A SUSTAINABILITY CHAMPION INVOLVEMENT WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS

(A)	Stage 0 Discovery	: Idea generation	1	2	3	4	5
	Gate1						
(B-1)	Stage 1 Scoping	: Preliminary assessment of market	1	2	3	4	5
(B-2)		: Preliminary assessment of technology	1	2	3	4	5
	Gate2						
(C-1)	Stage 2 Business Case Building	: Define product concepts	1	2	3	4	5
(C-2)		: Define design requirements & specifications	1	2	3	4	5
(D-1)		: Evaluate outcomes	1	2	3	4	5
(D-2)	Gate	: Agree / disagree to go to the next stage	1	2	3	4	5

2.B.3 PLEASE INDICATE THE EFFECTIVENESS OF HAVING A SUSTAINABILITY CHAMPION WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

Scale: 1 = NOT EFECTIVE AT ALL, 3 = NEUTRAL, 5 = VERY EFFECTIVE



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

2.B.4 PLEASE INDICATE THE VALUE OF SUSTAINABILITY CHAMPION IN ACHIEVING SUCCESS IN YOUR NPD ACTIVITIES (Write a number in the square):

Scale: 1 = NO, 3 = NEUTRAL, 5 = HIGH

						FREQUENCY
(A)	Communicating Among Team Members	1	2	3	4	5	☐
(B)	Communicating With Management	1	2	3	4	5	☐
(C)	Solving Inter-Personal Problems	1	2	3	4	5	☐
(D)	Tackling Technical Issues	1	2	3	4	5	☐
(E)	Giving Guidance and information on Sustainability Issues	1	2	3	4	5	☐
(F)	Acting As A Conduit To Correct Source of Information	1	2	3	4	5	☐
(G)	Motivating NPD Team	1	2	3	4	5	☐
(H)	Other (Please specify:)	1	2	3	4	5	☐

2.B.5 HOW WOULD YOU DEFINE SUCCESS IN RELATION TO HAVING A SUSTAINABILITY CHAMPION?

EXAMPLE?

C. SUSTAINABILITY TOOL(S)

2.C.1. PLEASE INDICATE THE IMPORTANCE OF USING SUSTAINABILITY (ASSESSMENT / DESIGN) TOOL(S) WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

SCALE: 1 = NOT IMPORTANT AT ALL, 3 = NEUTRAL, 5 = VERY IMPORTANT

(A)	Stage 0 Discovery	: Idea generation	1	2	3	4	5
	Gate1						
(B-1)	Stage 1 Scoping	: Preliminary assessment of market	1	2	3	4	5
(B-2)		: Preliminary assessment of technology	1	2	3	4	5
	Gate2						
(C-1)	Stage 2 Business Case Building	: Define product concepts	1	2	3	4	5
(C-2)		: Define design requirements & specifications	1	2	3	4	5
(D-1)		: Evaluate outcomes	1	2	3	4	5
(D-2)	Gate	: Agree / disagree to go to the next stage	1	2	3	4	5

2.C.2 PLEASE INDICATE THE FREQUENCY OF USING SUSTAINABILITY (ASSESSMENT / DESIGN) TOOL(S) WITHIN THE NPD ACTIVITIES (Write a number in the square):

SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS

	Stage 0	Stage 1	Stage 2	Gate
(A)LIFE CYCLE ASSESSMENT (LCA)	■	■	■	■
(B) ABRIDGED LIFE CYCLE ASSESSMENT (ALCA)	□	□	□	□
(C) ARPI ECO DESIGN FRAMEWORK	■	■	■	■
(D) ECOLOGICAL FOOTPRINT	□	□	□	□
(E) ECO POINTS	■	■	■	■
(F) ECO COMPASS	□	□	□	□
(I) Other (Please specify:)	■	■	■	■
(J) Your Company's own (Please specify:)	□	□	□	□

2.C.3 PLEASE INDICATE THE EFFECTIVENESS OF USING SUSTAINABILITY (ASSESSMENT / DESIGN) TOOL(S) WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

Scale: 1 = NOT EFECTIVE AT ALL, 3 = NEUTRAL, 5 = VERY EFFECTIVE

(A)	Stage 0 Discovery	: Idea generation	1	2	3	4	5
	Gate1						
(B-1)	Stage 1 Scoping	: Preliminary assessment of market	1	2	3	4	5
(B-2)		: Preliminary assessment of technology	1	2	3	4	5
	Gate2						
(C-1)	Stage 2 Business Case Building	: Define product concepts	1	2	3	4	5
(C-2)		: Define design requirements & specifications	1	2	3	4	5
(D-1)		: Evaluate outcomes	1	2	3	4	5
(D-2)	Gate	: Agree / disagree to go to the next stage	1	2	3	4	5

2.C.4 HOW WOULD TO DEFINE SUCCESS IN RELATION TO SUSTAINABILITY (ASSESSMENT / DESIGN) TOOL(S)?

EXAMPLE?

D. SUSTAINABILITY IN BRAND VISION

2.D.1 PLEASE DECRIBE YOUR COMPANY'S BRAND VISION:

-
-
-

2.D.2 PLEASE DESCRIBE YOUR COMPANY'S SUSTAINABILITY VISION:

-
-
-

2.D.3 PLEASE INDICATE THE IMPORTANCE OF SUSTAINABILITY TO YOUR COMPANY VISION:

SCALE: 1 = NOT IMPORTANT AT ALL, 3 = NEUTRAL, 5 = VERY IMPORTANT

1 2 3 4 5

2.D.4 PLEASE INDICATE THE FREQUENCY OF INTERNAL COMMUNICATION OF SUSTAINABILITY IN BRAND VISION WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS

(A)	Stage 0 Discovery	: Idea generation	1 2 3 4 5
	Gate1		
(B-1)	Stage 1 Scoping	: Preliminary assessment of market	1 2 3 4 5
(B-2)		: Preliminary assessment of technology	1 2 3 4 5
	Gate2		
(C-1)	Stage 2 Business Case Building	: Define product concepts	1 2 3 4 5
(C-2)		: Define design requirements & specifications	1 2 3 4 5
(D-1)		: Evaluate outcomes	1 2 3 4 5
(D-2)	Gate	: Agree / disagree to go to the next stage	1 2 3 4 5

2.D.5 PLEASE INDICATE THE <u>EFFECTIVENESS</u> OF INTERNAL COMMUNICATION OF SUSTAINABILITY IN BRAND VISION WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

Scale: 1 = NOT EFECTIVE AT ALL, 3 = NEUTRAL, 5 = VERY EFFECTIVE

(A)	Stage 0 Discovery	: Idea generation	1	2	3	4	5
	Gate1						
(B-1)	Stage 1 Scoping	: Preliminary assessment of market	1	2	3	4	5
(B-2)		: Preliminary assessment of technology	1	2	3	4	5
	Gate2						
(C-1)	Stage 2 Business Case Building	: Define product concepts	1	2	3	4	5
(C-2)		: Define design requirements & specifications	1	2	3	4	5
(D-1)		: Evaluate outcomes	1	2	3	4	5
(D-2)	Gate	: Agree / disagree to go to the next stage	1	2	3	4	5

2.D.6 PLEASE INDICATE THE <u>VALUE</u> OF SUSTAINABILITY IN BRAND VISION IN ACHIEVING SUCCESS IN YOUR NPD ACTIVITIES (Write a number in the square):

Scale: 1 = NO, 3 = NEUTRAL, 5 = HIGH FREQUENCY

(A)	Providing clearly defined brand vision	1	2	3	4	5	☐
(B)	Providing coherent brand experience across for consumer	1	2	3	4	5	☐
(C)	Providing clearly differentiated brand position within market	1	2	3	4	5	☐
(D)	Providing clearly defined set of brand values	1	2	3	4	5	☐
(E)	Other (Please specify:)	1	2	3	4	5	☐

2.D.7 HOW DOES <u>SUSTAINABILITY IN BRAND VISION</u> CONTRIBUTE TO SUCCESS?

EXAMPLE?

E. COMPANY CULTURE FOR SUSTAINABILITY

2.E.1 PLEASE INDICATE THE IMPORTANCE OF HAVING A COMPANY CULTURE FOR SUSTAINABILITY WIHTIN FOLLOWING ATTRIBUTES TO YOUR NPD ACTIVITIES (Write a number in the square):

SCALE: 1 = NOT IMPORTANT AT ALL, 3 = NEUTRAL, 5 = VERY IMPORTANT

	For your company	For You
(A) Clear, common sustainability goal		
(B) Commonly-held beliefs, attutides and values in sustainability		
(C) Independent & transparent sustainability corporate governance		
(D) Participative leadership		
(E) Enterpreneurial sustainability behavior		
(F) Continuity in sustainability leadership		
(G) Focus on innivation, ability to integrate sustainability		
(H) Consistent focus on customer		
(I) Focus on profitable sustainable growth		
(J) The acceptance of corporate citizenship		
(K) Other (Please specify:)		

2.E.2 PLEASE INDICATE THE FREQUENCY OF APPEARANCE OF FOLLOWING COMPANY CULTURE ATTRIBTES (Write a number in the square):

SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS

	For your company
(A) Clear, common sustainability goal	
(B) Commonly-held beliefs, attutides and values in sustainability	
(C) Independent & transparent sustainability corporate governance	
(D) Participative leadership	
(E) Enterpreneurial sustainability behavior	
(F) Continuity in sustainability leadership	
(G) Focus on innivation, ability to integrate sustainability	
(H) Consistent focus on customer	
(I) Focus on profitable sustainable growth	
(J) The acceptance of corporate citizenship	
(K) Other (Please specify:)	

2.E.3 PLEASE INDICATE THE EFFECTIVENESS OF FOLLOWING ATTRIBUTES WITHIN YOUR COMPANY CULTURE FOR SUSTAINABILITY (Write a number in the square):

Scale: 1 = NOT EFECTIVE AT ALL, 3 = NEUTRAL, 5 = VERY EFFECTIVE

	For your company
(A) Clear, common sustainability goal	
(B) Commonly-held beliefs, attutides and values in sustainability	
(C) Independent & transparent sustainability corporate governance	
(D) Participative leadership	
(E) Enterpreneurial sustainability behavior	
(F) Continuity in sustainability leadership	
(G) Focus on innivation, ability to integrate sustainability	
(H) Consistent focus on customer	
(I) Focus on profitable sustainable growth	
(J) The acceptance of corporate citizenship	
(K) Other (Please specify:)	

2.E.4 PLEASE INDICATE THE VALUE OF SUSTAINABILITY-RELATED ISSUES IN ACHIEVING SUCCESS IN YOUR NPD ACTIVITIES (Write a number in the square):

Scale: 1 = NO, 3 = NEUTRAL, 5 = HIGH

		FREQUENCY
(A) Reducing complexity	1 2 3 4 5	
(B) Coordinating actions	1 2 3 4 5	
(C) Providing a source of meaning	1 2 3 4 5	
(D) Providing continuity	1 2 3 4 5	
(E) Other (Please specify:)	1 2 3 4 5	

2.E.5 PLEASE INDICATE THE NATURE OF YOUR SUSTAINABILITY-PRACTICE WITHIN YOUR COMPANY CULTURE:

Scale: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS

(A) Formal	1 2 3 4 5
(B) Structured	1 2 3 4 5

2.E.6 HOW WOULD YOU DEFINE SUCCESS IN REALTION TO THE COMPANY CULTURE FOR SUSTAINABILITY?

EXAMPLE?

.....

F. SUSTAINABLE DESIGN PRACTICE

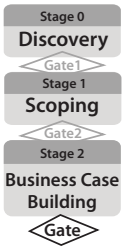
2.F.1 . PLEASE INDICATE THE TYPICAL SUSTAINABLE DESIGN EMPHASIS THAT YOU AND YOUR COMPANY ADOPT (Write a number in the square):

SCALE: 1 = NEVER, 3 = SOMETIMES, 5 = ALWAYS

	For your company	For You
(A) Design focusing on a single environmental issue i.e. recycle or material		
(B) Design that tackles all the environmental impact across the product life cycle		
(C) Design that considers the environment, society, and economic advantages holistically		

2.F.2 PLEASE INDICATE THE IMPORTANCE OF IMPLEMENTING SUSTAINABLE DESIGNS WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

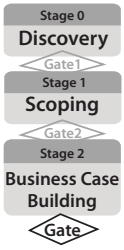
SCALE: 1 = NOT IMPORTANT AT ALL, 3 = NEUTRAL, 5 = VERY IMPORTANT



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

2.F.3 PLEASE INDICATE THE FREQUENCY OF IMPLEMENTING SUSTAINABLE DESIGNS WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

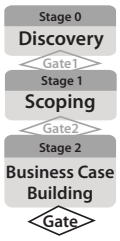
SCALE: 1 = NEVER, 3 =SOMETIMES, 5 = ALWAYS



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

2.F.4 PLEASE INDICATE THE EFFECTIVENESS OF IMPLEMENTING SUSTAINABLE DESIGNS WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

Scale: 1 = NOT EFECTIVE AT ALL, 3 = NEUTRAL, 5 = VERY EFFECTIVE



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

2.F.5 HOW WOULD YOU DEFINE SUCCESS IN RELATION TO SUSTAINABLE DESIGN PRACTICES?

EXAMPLE?

G. PERSONAL ASPECTS

2.G.1 . PLEASE INDICATE YOUR PERSONAL IMPORTANCE OF IMPLEMENTING SUSTAINABLE DESIGNS WITHIN THE NPD ACTIVITIES:

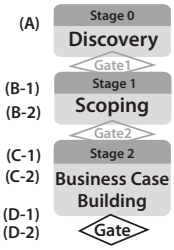
SCALE: 1 = NOT IMPORTANT AT ALL, 3 = NEUTRAL, 5 = VERY IMPORTANT

1 2 3 4 5

.....

2.G.2 PLEASE INDICATE YOUR PERSONAL FREQUENCY OF IMPLEMENTING SUSTAINABLE DESIGNS WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

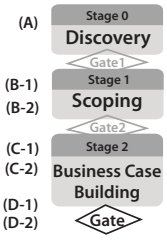
SCALE: 1 = NEVER, 3 =SOMETIMES, 5 = ALWAYS



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

2.G.4 PLEASE INDICATE YOUR PERSONAL PERCEPTION OF SUCCESS OF IMPLEMENTING SUSTAINABLE DESIGNS WITHIN THE FOLLOWING FRONT-END NPD ACTIVITIES:

Scale: 1 = NOT SUCCESSFUL AT ALL, 3 = NEUTRAL, 5 = VERY SUCCESSFUL



(A)	: Idea generation	1	2	3	4	5
(B-1)	: Preliminary assessment of market	1	2	3	4	5
(B-2)	: Preliminary assessment of technology	1	2	3	4	5
(C-1)	: Define product concepts	1	2	3	4	5
(C-2)	: Define design requirements & specifications	1	2	3	4	5
(D-1)	: Evaluate outcomes	1	2	3	4	5
(D-2)	: Agree / disagree to go to the next stage	1	2	3	4	5

2.G.5 HOW WOULD YOU DEFINE YOUR PERSONAL SUCCESS IN RELATION TO SUSTAINABLE DESIGN PRACTICE?

EXAMPLE?

.....

• ANY OTHER COMMENTS ABOUT THIS RESEARCH?

Thank you very much for your participation. I hope you found this questionnaire interesting. A summary of research findings will be sent to you on completion of the study. If you have any comments or enquiry, please contact curieous@gmail.com (c.park@cranfield.ac.uk).

CURIE PARK, PhD Candidate
Cranfield University, Bedfordshire, UK
May, 2013

Appendix D. Verification questionnaire: Data collection Phase 2

Research Questionnaire

Distinctive Success Factors for Sustainable Design Implementation in the New Product Development Process

• **Personal Information**

Name: _____ Date: _____

Company: _____ Department: _____

Position: _____ Job area: Project / Corporate

Experience in this job (in years): _____ Email address: _____

This questionnaire aims to collect industry data that can help identify distinctive success factors that contribute to successful development of more sustainable products in the Front-End stages of the New Product Development (NPD) process (Cooper, 1990) within the Fast-Moving-Consumer-Goods (FMCG) sector. The unit of analysis is the front-end stages of the NPD process: Stage 0, 1, 2 and gates based on the Stage-Gate model of NPD process.

• **Confidentiality notice**

The collected data will remain anonymous and will be used for a doctoral research project and related academic journal publication only.

• **Please answer the below questions in regards of the early (Front-End) stages of the New Product Development process in your company.**

• **Idea Generation**

1. What are the drivers for new product ideas in your company?

2. What are the challenges in the idea generation stage for new product development?

A. Consumer Focus

	Never		Neutral		Very
A.1. How important is to have consumer focus at the early stages of the new product development in your company?	1	2	3	4	5
A.2. How often are those stages consumer focused?	1	2	3	4	5
A.3. How effective is it?	1	2	3	4	5

A.4. Any example?

B. Senior Management Support

	Never		Neutral		Very
B.1. How important is the senior management support at the early stages of the new product development in your company?	1	2	3	4	5
B.2. How sufficient is the senior management support at those stages?	1	2	3	4	5
B.3. How effective is it?	1	2	3	4	5

B.4. Any example?

B.5. What are the challenges regarding senior management support in your company?

B.6. Are financial incentives provided to the individual with sustainability achievement in your company? Yes ☐ No ☐

B.6-1. Are there any other incentives?

B.6-2. If NO, is there a need for incentives? Yes ☐ No ☐

• **Please answer the below questions in regards of the early (Front-End) stages of the New Product Development process in your company.**

C. Internal Communication

	Never		Neutral		Very
C.1. How important is internal communication at the early stages of your new product development in your company?	1	2	3	4	5
C.2. How often is sustainability communicated at those stages?	1	2	3	4	5
C.3. How effective is it?	1	2	3	4	5
C.4. How easy is to communicate among seniors and juniors?	1	2	3	4	5

C.5. What kind of communication channels exists in your company?

D. Cross-Functional Team

	Never		Neutral		Very
D.1. How important is working as a cross-functional team at the early stages for sustainability in your company?	1	2	3	4	5
D.2. How often do you work as a cross-functional team?	1	2	3	4	5
D.3. How effective is it?	1	2	3	4	5

D.4. Is there a sustainability manager (or officer) in your company? Yes ☐ No ☐

D.4-1. If YES, does this person come in the early stages? Yes ☐ No ☐

D.5. Which department does typically initiate the new product development?

D.6. Who else comes in the idea generation stage?

E. Sustainability Wording

E.1. How often do(does) you, your company, and your consumer use the following respectively?

* Please insert numbers in the box *
[scale: Never1, Neutral 3, Always 5]

	You	Your Company	Your Consumer
Green Design	☐	☐	☐
Eco Design	☐	☐	☐
Design for the Environment	☐	☐	☐
Sustainable Design	☐	☐	☐
Other (Please specify:)	☐	☐	☐

• **Please answer the below questions in regards of the early (Front-End) stages of the New Product Development process in your company.**

E.2. Is there an agreed wording to use (from E.1) in your company? Yes ☐ No ☐

E.2-1. If YES, which one is it?

E.3. How important to use an agreed wording? Never 1 2 3 4 5 Very

E.4. Why (or why not)?

F. Sustainability Champion

* **Sustainability champion** (environmental coordinator/advisor):
A person in charge of the sustainability consideration in design, often from middle manager level

F.1. How important is to have a sustainability champion in the early stage of the NPD in your company? Never 1 2 3 4 5 Very

F.2. Is there a such person in your company? Yes ☐ No ☐

F.2-1. If YES, how often does this person come in the early stage? 1 2 3 4 5

F.2-2. If YES, How effective is it? 1 2 3 4 5

F.3. If NO, is there a need for one? Yes ☐ No ☐

F.3.-1.Why (or why not)?

G. Sustainability Tools

G.1. How important is to use a sustainability tool(s) in the early stage of the NPD in your company? Never 1 2 3 4 5 Very

G.2. Are any sustainability tool(s) used in your company? Yes ☐ No ☐

G.2-1. If YES, please specify (including company's own):

G.2-2. If YES, How often are they used? 1 2 3 4 5

G.2-3. If YES, How effective are they? 1 2 3 4 5

G.3. If NO, is there a need for one? Yes ☐ No ☐

G.3-1.Why (or why not)?

H. Sustainability Vision

H.1. What is your company's vision?

.....

H.2. What is your company's sustainability vision?

.....

H.3. How important is to have sustainability within your company vision? Never 1 2 Neutral 3 4 Very 5

H.4. Why (or why not)?

.....

I. Corporate Culture of Sustainability

I.1. Do you think there is culture of sustainability in your company? Yes ☐ No ☐

I.2. How important is sustainability transparency in your corporate culture? Never 1 2 Neutral 3 4 Very 5
Any example?

.....

I.3. How important is sustainability legacy in your corporate culture? Never 1 2 Neutral 3 4 Very 5
Any example?

.....

I.4. How important is sustainability innovation in your corporate culture? Never 1 2 Neutral 3 4 Very 5
Any example?

.....

I.5. How important is sustainability behaviour in your corporate culture? Never 1 2 Neutral 3 4 Very 5
Any example?

.....

I.6. How important is sustainability belief in your corporate culture? Never 1 2 Neutral 3 4 Very 5
Any example?

.....

I.7. How important is sustainability citizenship in your corporate culture? Never 1 2 Neutral 3 4 Very 5
Any example?

.....

I.8. How structured is sustainability practice in your corporate culture? Never 1 2 Neutral 3 4 Very 5
Any example?

.....

J. Focus on Growth

J.1. How important is the growth in your company?

Never 1 2 Neutral 3 4 Very 5

J.2. Why (or why not)?

.....

J.3. How much influence does sustainability have in your company's growth?

Never 1 2 Neutral 3 4 Very high 5

J.4. Which brand has the strongest sustainability focus in your company?

.....

J.5. What are the challenges in the pursuit of growth and sustainability?

.....

K. Sustainable Design Implementation

K.1. What is the typical sustainable design emphasis in your company?

	Never		Neutral		Very high
I) Design focusing on a single environmental issue i.e. recycle, material	1	2	3	4	5
II) Design that covers all environmental impacts across product life cycle	1	2	3	4	5
III) Design that considers the environment, society, and economic advantages holistically	1	2	3	4	5

K.2. How receptive is your target market about sustainable design? 1 2 3 4 5

K.3. How sufficient is the infra-structure to implement sustainable design? 1 2 3 4 5

K.4. Please give an example of successful or unsuccessful sustainable design implementation in your products.

.....

L. Individual Attitude

L.1. How important is achieving sustainable design to you?

Never 1 2 Neutral 3 4 Very high 5

L.2. How satisfying is the current sustainability practice to you? 1 2 3 4 5

L.3. Do you have your own sustainability goal? Yes ☐ No ☐

L.3-1. If YES, what is it?

.....

L.4. What is the biggest challenge in achieving sustainability for you?

.....

* The aim of this research is to 'Identify Distinctive Success Factors for Sustainable Design Implementation in the New Product Development Process.' Do you have any other comments regarding the research?

.....

Thank you very much! I hope you find this questionnaire of your interest.

Please send back the completed questionnaire to Curie Park via email: c.park@cranfield.ac.uk

A summary of research findings will be sent to you on completion of the study. Should there is anything you want to clarify or comment, I would love to hear from you.

Curie Park
PhD researcher
2013

Centre for Competitive Creative Design
Cranfield University
Bedfordshire
UK

c.park@cranfield.ac.uk
www.centrefordesign.com
+44 (0) 7426 944 412

Appendix E. Research collaboration request letter

Cranfield UNIVERSITY

Curie Park
Doctorate researcher
Centre for Competitive Creative Design, Cranfield University
www.centrefordesign.com
tel_07426 944 412
e_c.park@cranfield.ac.uk

Dear

Request for research collaboration

Having obtained your contact from my PhD supervisor Dr. Fiona Charnley, Cranfield University, I am writing to you to request for interviews regarding a PhD research. The research is to indentify '**Distinctive Success Factors for Sustainable Design Implementation in the New Product Development Process'** within the Fast Moving Consumer Goods (FMCG) sector.

I have already collected data from Natura (Brazil) and Amore Pacific (South Korea) (Note: they have given permission to be mentioned). I strongly wish Innocent would collaborate with us to provide with the valuable knowledge and experiences of an world-leading success case. The research collaboration details are as follows.

- Benefits - Report with suggestions to improve the sustainability of products within development process
  - Comparative case studies of sustainability practices including three other firms around the world
  - Presentation of overall results and conclusions (on request)
- Costs: - 2-3 interviewees for a questionnaire interview for 30 minutes each
- Risks & Confidentiality - Name of interviewee and company will remain anonymous
  - Interviews will be audio-recorded by permission for transcription purpose only
  - Collected data will be used for a PhD research and related academic publication only

Since Innocent has been a fascinating company with its rigorous sustainability practices, your participation will make the research complete. Moreover, sharing your valuable knowledge and experiences will contribute to the industry who wish to improve its sustainability practice at a multinational scale. We will look forward to our collaboration.

Your faithfully,

Curie Park

Cranfield UNIVERSITY

Research Outline

Research Title

Distinctive Success Factors for Sustainable Design Implementation in the NPD (New Product Development) Process

Objectives

- To identify success factors for sustainable design implementation within the FMCG sector

Requirements

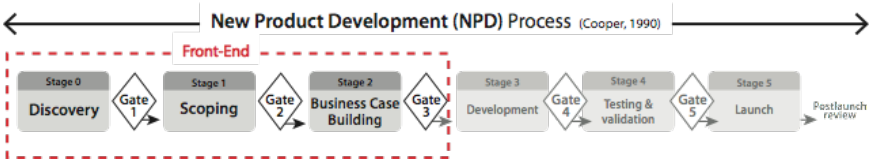
- 2-3 Questionnaire-based interview for 30 minutes with employees from different level
i.e. Managing or Sustainability Director / Marketing & Brand Manager / Product developer or Designer

Samples

Leading FMCG (Fast-Moving-Consumer-Goods) firms around the world

Research background

Sustainable design is a new business imperative. In order to maximise the benefit of sustainable design in practice, it is required to identify the success factors for effective implementation of it. Given that internal communication, consumer involvement, senior management support, and cross-functionality are common success factors for both NPD and sustainable design implementation, what are the distinctive factors for sustainable design implementation above common factors?



About the researcher

Trained as a product designer, Curie Park has run her own design studio to commission design projects, to write sustainable design articles, and to give sustainable design lectures in South Korea. She is also an active member of MicroHabitat, the creative nature conservation group in Korea. Her major focus is to understand how to utilise design in pursuit of sustainability. She is a 3rd year PhD student at Cranfield University.

Appendix F. Transcription sample Company A

Company: XXX
Date: 15th May 2013
Name: XXX
Position: CORPORATE BRAND manager / Corporate level
Duration: 1h 54' 08"

Introduction
5'06''
L: In my department there are brand culture and internal communication directory. Organizational structure…. Our definition of **branding is culture.** Branding is much more than what we say. **It's what we do, how we behave, how we build relationships, how we express ourselves and we share values**. And in this sense **the culture is everything what we do.** The internal communication is one of the most important tools to build the desired culture. We don't have internal communication in a usual functional way. But we have this cultural view of all the internal communication strategy that is how we communicate and relate with, there is a strategic priority is on the employees to build the desired culture and the long-term strategy, and to reinforce the core message and the desired behavior. So this is the strange structure we do with branding and culture. And other particularity of Natura is that we don't produce any communication materials, we have marketing & Communication department totally separately for that. My job is inspiring, providing, training and measuring the strategic guidelines. But we do not execute. The only thing we execute is the internal communication. But we are responsible for providing the whole company with the right direction and right training… we treat the touch points Natura experiences… everything from the way you answer a call, the way you deal with a supplier making an agreement or contract… as everything is brand expression. We need to have people well prepared. We cannot control people. At the end, we have a million and half consultants that directly in touch with the consumers. So how we qualify the whole chain to be able to express the coherent and consistent brand experience. We are focusing on building the value, in the perspective of value proposition. And **the value is built at the very beginning**. There is no magic in the end. Unless you have this very consistently built communication, you cannot create or invent the value. (아직 삽입 안한 부분-문화/소통/브랜드/밸류/행동이 다 엉켜있음… 잘 풀어보자)

I am always looking into our intention, strategy, actions and perception… because that's the brand at the end of the day. (나투라 브랜드의 정의)

Brand architecture is inside out, organic guide to create the value. From the very essence and the very core of Natura. The reason for being is WELL BEING WELL.

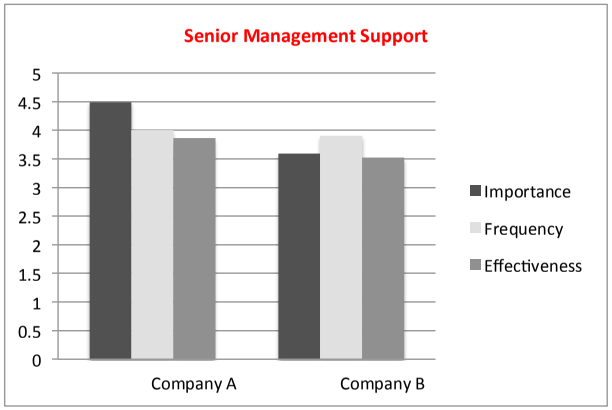
C: What is the vision?
L: **Our vision is to be a global brand with an international expression, identified with the communication with the construction of the better world.** We don't talk about being a world leader, producing cosmetics, being international brand but connected with the community to construct the better world. (The full sentence is in the website) The **belief is in sustainability, we believe that life is a chain of relationship,** The truth is the best way to build the strong / valuable relationships, we believe in the beauty as a very legitimate will of human-being. The beauty must be free of the conceived ideas or prejudice, (16'48''). We believe company is a living organism, ecosystem… is always evolving, changing and the company has a role as in the society. It is a transformation agent. These are the core of the company, how we see the world.

19' 27''
We talk a lot about Brazilianness. As Paris to L'oreal. There is a Perubian brand Lebel but they call it Lebel Paris because they want the image of Paris. But it's not the way we talk about Brazil. Our way is much more cultural because we are rooted here. When we do thing, it's totally correlated. We are very diverse and comfortable at dealing with diversity. We are very warm, we like and we cherish the relationship. We have a cultural approach that we respect our roots the place where we are. We talk about emotional aspects but in a different perspective. And **we want to be perceived as a sustainable brand,** as a brand that cares about relationship, as a brand that amplifies your consciousness, as a brand that is committed to the truth. That's out aspiration. When we talk about value proposition, it has two pillars. We want to deliver value in product channel and **corporate behavior**. Others usually don't have corporate behavior as value proposition. But for us they have a same value.

1. Packaging development coordinator 2. Marketing manager 3. Corporate brand manager 4. Strategic planning director 5. Sustainability R&D manager 6. Eco design manager 7. R&D researcher

Com.	Themes	sub-themes	sub-sub themes	interviewee level		
				High (Director)	Middle (Manager)	Low (Employee)
	3. Internal communication	3.1. Formality		Not much structured.	they meet every week A lot of meetings, always almost formal meeting... Every week. Sometimes more.	the weekly meeting we shared all the information
		3.2. Frequency / effectiveness		It's important but frequency and effectiveness is rather neutral... we sometimes have TOO many people involved on the discussion, or not necessary people are involved, etc. It's not about the communication itself, but it's more about the governance.	Effectiveness. Four. We are very concerned about how we communicate. I think it works well because they meet every week. There is no problem in communication. The weekly meeting starts from the stage 1. There is no serious communication issue at the project level. (contrasting!) They say it's important but it's not happening at stage 0. But when it's happening (from stage 1 onward) it's effective.	So you have 2-3 hours to talk about the whole project but sometimes we had to focus on certain problems that were more important then we didn't have enough time to share everything. (project level) Frequency is fine. The point is the effectiveness. Because sometimes it's not so good. Sometime we start with a concept. And we change in the middle of the project. The communication does not go through. So we continue working with the old concept. (실무자로서 느끼는 커뮤니케이션 문제) (corporate level)
		3.3. Challenge		We are trying to be inclusive in the decision making process (gates). ... the intensity of participation is higher at the gates		if someone doesn't work hard, let's say design team... the end- result is not OK. It's all connected with the internal communication. It's really complex as it's not TECHNICAL BUT behaviour (중요한 말!). You should be able to think about the future of the project. So it's better to share the problem NOW.

Senior m. supp	Importance	Frequency	Effectiveness	Mean±S.D.	Co.Var.
Company A	4.49	4	3.86	3.03±0.54	18%
Company B	3.59	3.9	3.52	3.33±0.33	10%



A사는 전형적으로 빈도와 효율성이 낮은 그래프
* B사는 수직관계가 보편적인 문화적 특성상 상위경영진의 지원을. 간섭으로 인식하여 빈도는 높으나 중요도와 효율성이 낮다고 나옴 (정성분석 참고할 것)
따라서 중요성도 낮다고 나옴

A가 비교적 숫자가 높으나 B가 낮은 평균으로 고른 편- 좋은 건 아님. A의 경우 시니어 매니저에 대한 기대치가 높다 할 수 있음

S. vision	Importance	Frequency	Effectiveness	Mean±S.D.	Co.Var.
Company A	5	4.8	4.65	4.82±0.18	4%
Company B	4.43	4.17	3.78	4.13±0.33	8%

A사의 비전은 회사 비전과 지속가능이 거의 완전 합치수준. 그러나 빈도와 효율성은 약간 떨어짐
B사도 전형적인 하향 패턴이나 경사가 급하고 전반적으로 중요도 인식, 혹은 비전 인식 자체가 안되어있음 (정성분석 참고)

A의 비전 중요성 만점.진짜 좋은 케이스. CV 낮음.
트라이앵귤레이션이 안 되어도 무관.
B는 효과가 낮음- 정량에서는 안나오지만 정성에서 보면 형편없음.

Appendix I. Email confirmation on Research Ethics level 'Low Risk'

Ethics Proposal 014-2014
SEREC
Sent:21 February 2014 11:32
To: Park, Curie

Dear Curie

Your proposed research activity "Influencing factors for sustainable design implementation within the FMCG sector" has been reviewed by SEREC and confirmed as posing a low risk in terms of research ethics. You can now proceed with the research activities you have sought approval for and we wish you a successful project.

Concerning the need to gain agreement from each interviewee, it is suggested that the interviewer reads a form of words (to be agreed and, it is suggested, similar to what is usually written at the top of each written questionnaire) and this is recorded as part of the interview, which is being recorded anyway.

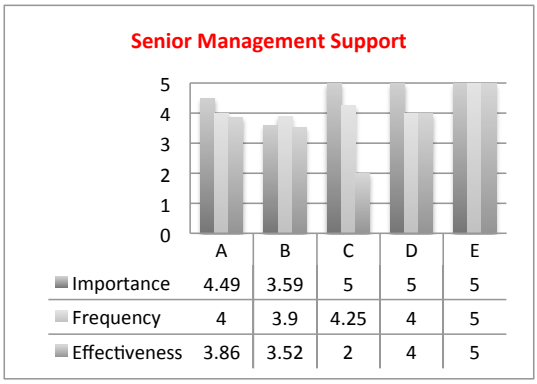
Please remember that SEREC occasionally conducts audits of low risk projects and we may therefore contact you during or following execution of your fieldwork to verify that you are following good practice.

Guidance on good practice is available at:
https://intranet.cranfield.ac.uk/researchethics/Pages/SEREC.aspx

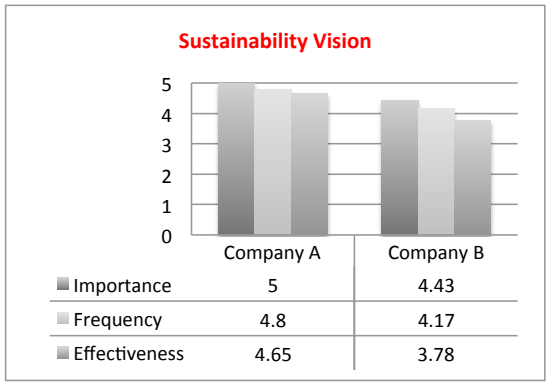
With best regards

Sue Garrod
Secretary
Centre for Advanced Systems
Aerospace Engineering Division
School of Engineering
01234 754165

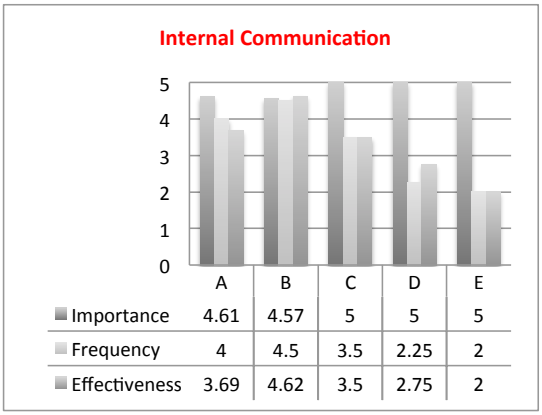
Appendix J. Consolidation of quantitative data in column charts



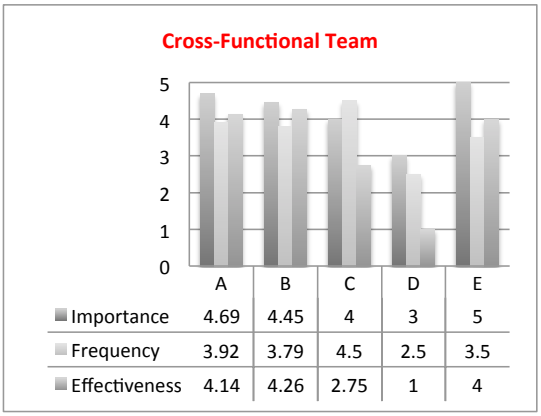
	A	B	C	D	E
Importance	4.49	3.59	5	5	5
Frequency	4	3.9	4.25	4	5
Effectiveness	3.86	3.52	2	4	5



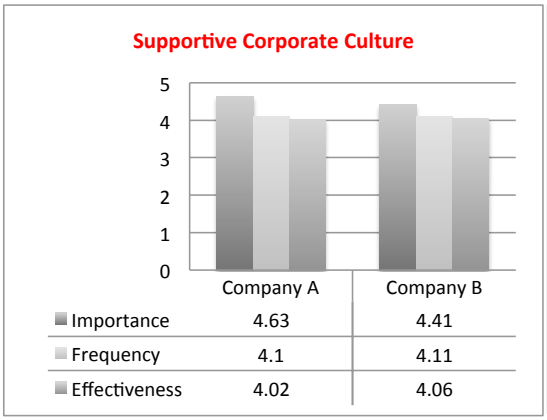
	Company A	Company B
Importance	5	4.43
Frequency	4.8	4.17
Effectiveness	4.65	3.78



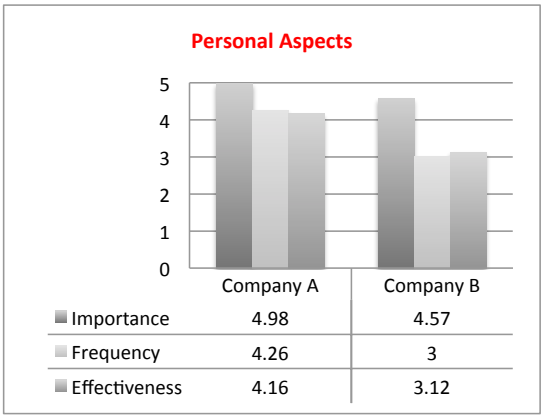
	A	B	C	D	E
Importance	4.61	4.57	5	5	5
Frequency	4	4.5	3.5	2.25	2
Effectiveness	3.69	4.62	3.5	2.75	2



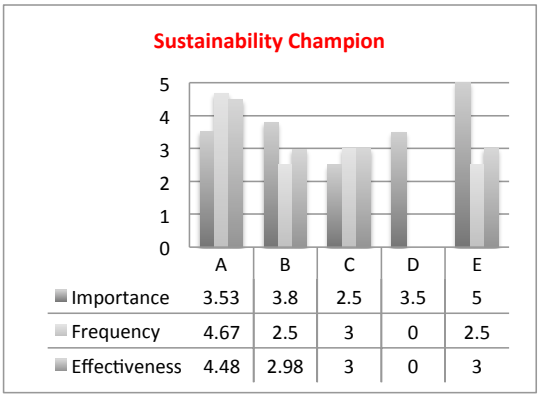
	A	B	C	D	E
Importance	4.69	4.45	4	3	5
Frequency	3.92	3.79	4.5	2.5	3.5
Effectiveness	4.14	4.26	2.75	1	4



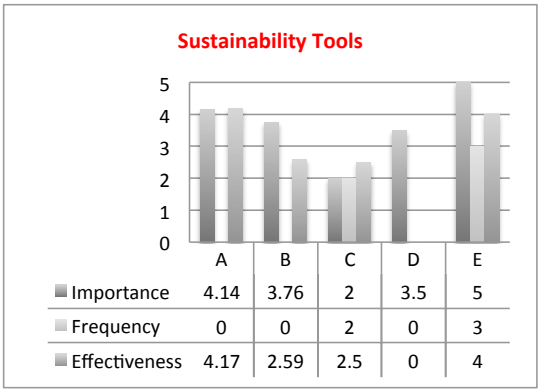
	Company A	Company B
Importance	4.63	4.41
Frequency	4.1	4.11
Effectiveness	4.02	4.06



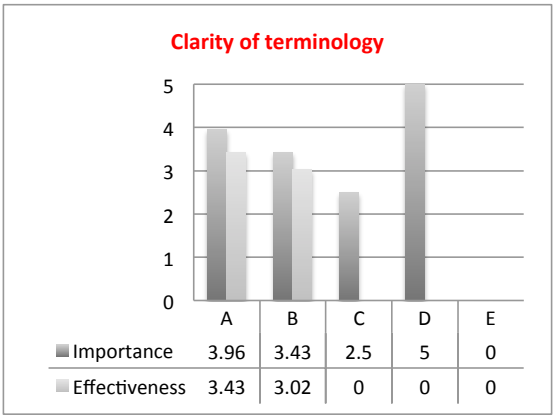
	Company A	Company B
Importance	4.98	4.57
Frequency	4.26	3
Effectiveness	4.16	3.12

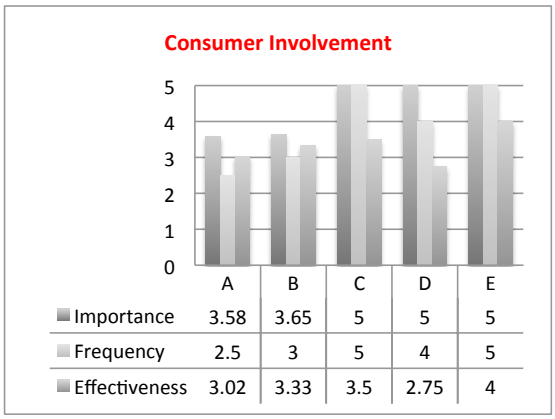


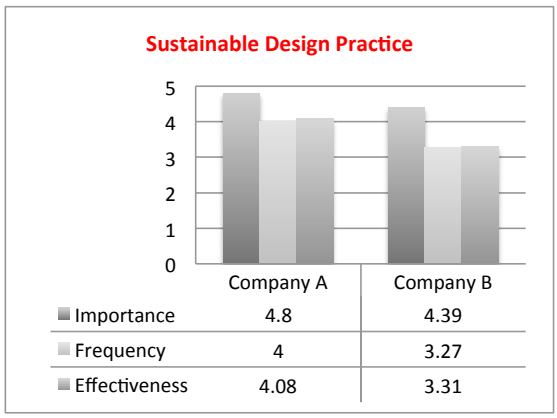
	A	B	C	D	E
Importance	3.53	3.8	2.5	3.5	5
Frequency	4.67	2.5	3	0	2.5
Effectiveness	4.48	2.98	3	0	3



	A	B	C	D	E
Importance	4.14	3.76	2	3.5	5
Frequency	0	0	2	0	3
Effectiveness	4.17	2.59	2.5	0	4


Clarity of terminology
5
4
3
2
1
0
A B C D E
Importance 3.96 3.43 2.5 5 0
Effectiveness 3.43 3.02 0 0 0


Consumer Involvement
5
4
3
2
1
0
A B C D E
Importance 3.58 3.65 5 5 5
Frequency 2.5 3 5 4 5
Effectiveness 3.02 3.33 3.5 2.75 4


Sustainable Design Practice
5
4
3
2
1
0
Company A Company B
Importance 4.8 4.39
Frequency 4 3.27
Effectiveness 4.08 3.31